



THE KUWAITI BOARD OF
PEDIATRICS

COMMON DISEASES AND EMERGENCY CODES

FIFTH EDITION



THE KUWAITI BOARD
OF PEDIATRICS
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Acknowledgement

The fifth edition of this book would not have been possible without the tremendous efforts of the hardworking residents and physicians who wrote and edited the first four editions. Thank you for making our job easier. We hope that this book continues to be a valuable resource to our pediatric residents and physicians now and in the future.

Thank you to the team of residents who helped edit and update the fifth edition.

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for their incredible work that made this book what it is today, as well as their incredible team of writers and editors. Please see *Credits and Contributions* at the end of this book.

For changes made to this edition, please see *Appendix A*.

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Contents

VITALS

Vital signs in pediatrics	1
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CARDIOVASCULAR SYSTEM AND RSI

Pediatric cardiac arrest	2
Tachycardia with a pulse	3
Bradycardia with a pulse	4
Septic shock	5
Rapid sequence intubation	6
Tet spell	8
Hypertensive crisis	9

NEUROLOGY

Comatose child	11
Status epilepticus	13

RESPIRATORY

Bronchiolitis	14
Asthma	16
Croup	19

NEONATOLOGY

Neonatal resuscitation	21
Newborn hypoglycemia	23
Neonatal jaundice	24

METABOLIC

Metabolic emergency (1st presentation)	28
Hyperammonemia	29
VLCAD	31

ENDOCRINE & ELECTROLYTES

Hypocalcemia	32
Potassium	33
Sodium	35
Hypoglycemia	38
DKA	39

ALLERGY

Anaphylaxis	42
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Contents

INFECTIOUS DISEASES

Neonatal fever (0-21 days)	43
Neonatal fever (22-28 days)	44
Well febrile infant (29-90 days)	45
Ill febrile infant (29-90 days)	46
Fever without a focus (3-36 months)	47
Non-chemotherapy induced febrile neutropenia	48
Pediatric antibiotic guidelines	50

HEMATOLOGY

Fever in sickle cell disease	52
Vaso-occlusive crisis in sickle cell disease	53
Acute chest syndrome	54
Bleeding tendency	55

RHEUMATOLOGY

Complete Kawasaki	56
Incomplete Kawasaki	57

TOXICOLOGY

Important toxicology mnemonics	58
Acute Acetaminophen ingestion	60
Organophosphate and carbamate poisoning	62
Hydrocarbon ingestion	63

TRAUMA & ACCIDENTS

Minor head trauma <2 years	64
Minor head trauma ≥ 2 years	65
Drowning (submersion)	66
Burns	67

MISCELLANEOUS

Emergency medications	71
Infusions	75
Vaccination schedule (Kuwait, 2019)	76
Reading a chest x-ray	77

APPENDIX

Appendix A: Changes made in the fifth edition	79
Appendix B: References	82
Appendix C: Credits and contributions	88

Vital Signs in Pediatrics

Heart rate (per minute)		
Age	Awake rate	Sleeping rate
Neonate	100-205	90-160
Infant	100-180	90-160
Toddler	98-140	80-120
Preschooler	80-120	65-100
School-aged child	75-118	58-90
Adolescent	60-100	50-90

Respiratory rate (per minute)	
Age	Rate
Infant	30 - 53
Toddler	22 – 37
Preschooler	20 – 28
School-aged child	18 – 25
Adolescent	12 – 20

Hypotension by systolic blood pressure*	
Age	Systolic blood pressure (mmHg)
Term baby (0-28 days)	< 60
Infant (1 – 12 months)	< 70
Children (1 – 10 years)	< 70 + (age in years x 2)
Children (>10 years)	< 90

*Please note that these are only rough BP measures and for accurate levels please refer to centile charts by gender, age, and height centiles

GLASCOW COMA SCALE

	Child	Infant	Score
Eye opening	Spontaneous	Spontaneous	4
	To speech	To speech	3
	To pain	To pain	2
	None	None	1
Best verbal response	Oriented, appropriate	Coos and babbles	5
	Confused	Irritable, cries	4
	Inappropriate speech	Cries in response to pain	3
	Incomprehensible sounds	Moans in response to pain	2
	None	None	1
Best motor response*	Obeys commands	Moves spontaneously and purposely	6
	Localizes painful stimulus	Withdraws in response to touch	5
	Withdraws in response to pain	Withdraws in response to pain	4
	Flexion in response to pain	Abnormal flexion in response to pain	3
	Extension in response to pain	Abnormal extension in response to pain	2
	None	None	1

If the child is intubated, unconscious or preverbal, the most important part of this scale is motor response.

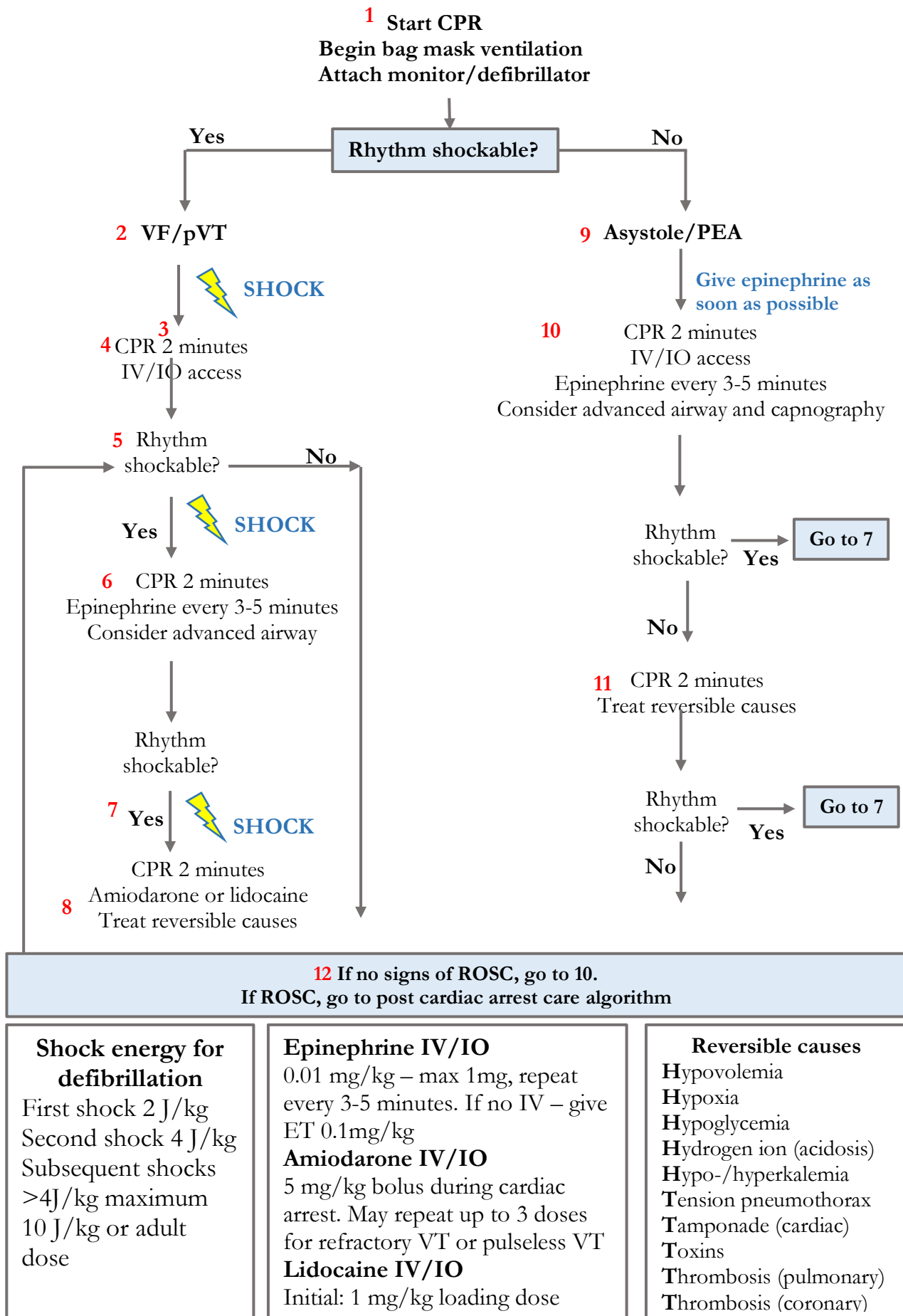
ENDOTRACHEAL TUBE SIZES

Age	Uncuffed	Cuffed
GA < 28 wks (or < 1 kg)	2.5	—
GA 28 - 34 wks (or 1 - 2 kg)	3	—
GA 34 - 38 wks (or 2 - 3 kg)	3.5	—
Term 0 - 28 days (> 3 kg)	3.5 – 4	—
Infant (1 - 12 months)	3.5	3
Child (1 - 8 years)	4+ age in years/4	3.5 + age in years/4

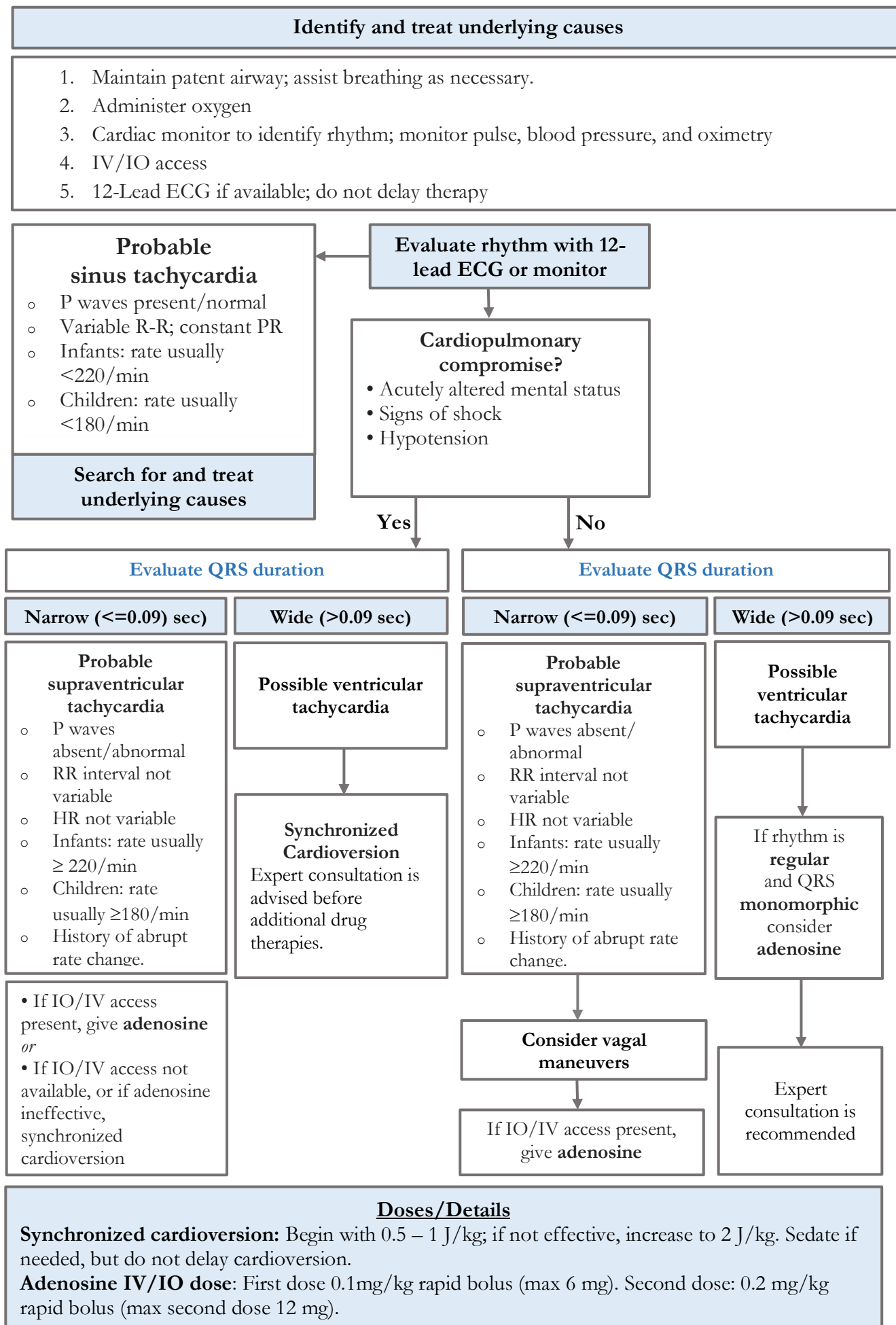
*GA = Gestational age

SURFACE AREA

$$\sqrt{\frac{\text{Height (cm)} \times \text{Weight (Kg)}}{3600}}$$



Pediatric Tachycardia with a Pulse



Bradycardia with a pulse

Cardiopulmonary compromise?

- Acutely altered mental status
- Signs of shock
- Hypotension

No

Yes

Assessment and support

- Maintain patent airway
- Assist breathing with positive pressure ventilation and oxygen as necessary
- Cardiac monitor to identify the rhythm; monitor pulse, BP and oximetry

Start CPR if HR <60 bpm despite oxygenation and ventilation

Bradycardia persists?

No

Yes

- Continue CPR if HR <60 bpm
- IV/IO access
- Epinephrine
- Atropine for increased vagal tone or primary AV block
- Consider transthoracic/transvenous pacing
- Identify and treat underlying causes

Yes

Check pulse every 2 mins
Pulse present?

No

Go to **pediatric cardiac arrest** algorithm

1. Support ABCs
2. Consider oxygen
3. Observe
4. 12-lead ECG
5. Identify and treat underlying causes

DOSES/DETAILS

Doses/Details

Epinephrine IV/IO:

0.01mg/kg (0.1mL/kg of the 0.1mg/ml concentration)

Repeat every 3-5 mins

If IV/IO access not available but endotracheal (ET) tube in place, may give ET dose: 0.1mg/kg (0.1mL/kg of the 1mg/mL concentration)

Atropine IV/IO:

0.02mg/kg. May repeat once
Minimum dose 0.1mg and maximum single dose 0.5mg

Possible causes:

Hypothermia/Hypoxia/Medications

IDENTIFY SEPTIC SHOCK

- Altered **mental status** (irritability or decreased level of consciousness).
- Altered **heart rate** (tachycardia or bradycardia).
- Altered **temperature** (fever or hypothermia).
- Altered **perfusion** CRT > 2s or CRT < 1s (flushed), cool or very warm extremities, plethoric appearance, mottled or pallor, possible ecchymosis or purpura, decreased urine output.

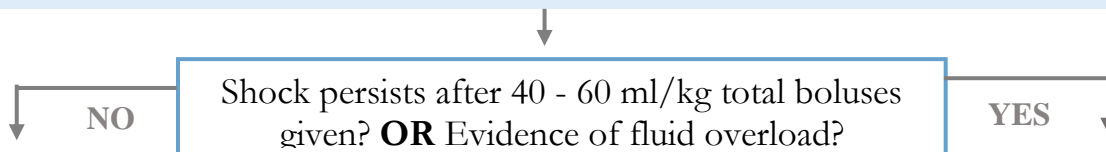
INITIAL STABILIZATION (WITHIN 10-15 MIN)

- Support **ABC**
- Attach to **cardiopulmonary monitor** (HR, BP, SpO2) and **oxygen**
- Establish **IV access** (trial within 90s, if failed, establish **IO access**)
- Fluid boluses: Give **10 to 20 ml/kg** of isotonic crystalloids boluses (*Push*) and assess carefully for fluid overload after each bolus.
 - Consider smaller boluses of 5ml/kg for children with suspected heart failure

WITHIN THE FIRST HOUR

- Draw **investigations** (CBC, CRP, PCT, BGA, lactate, Glu, iCa+). DO NOT DELAY ANTIBIOTICS OR FLUID THERAPY.
- Start **broad spectrum antibiotics**.
- **Repeat fluid boluses** as needed. Always assess for fluid overload after each bolus. **STOP** if:
 - Rales, respiratory distress, hepatomegaly, increasing tachycardia, or B- lines on lung POCUS
- **Antipyretics** if needed (paracetamol IV 15mg/kg)
- **Correct** hypoglycemia and hypocalcemia.

Therapy Goals: Improved mental status, HR and temperature normalization, adequate systolic and diastolic blood pressure, and improved perfusion.



**Consider
PICU**

- **CALL PICU**
- Start and titrate **vasoactive medications**:
 - Epinephrine 0.05 - 1.5 mcg/kg/min diluted in NS/D5
 - OR** • Norepinephrine 0.05 – 1.5 mcg/kg/min diluted in D5

- **Consider establishing central venous or intra-atrial pressure monitoring**
 - Note: epinephrine and norepinephrine infusions can initially be given through peripheral IV (with close observation on IV site to monitor for extravasation injury)
- **Continue epinephrine/norepinephrine & bolus fluids as needed.**
- **Verify adequate airway, oxygenation, and ventilation.**
 - Consider non-invasive ventilation or intubation if needed (intubation if necessary = high risk induction)
- **Corticosteroids** (stress dose hydrocortisone: 1-2 mg/kg, max 100mg/dose):
 - To give for patients with or at risk of secondary adrenal insufficiency.
 - May or may not help in fluid and inotrope refractory septic shock.

RAPID SEQUENCE INTUBATION

A sequential process of preparation, sedation, **WITH** paralysis for a safe emergency intubation.

- **Used when:**
 - Emergency intubation is needed in patients who are presumed to have a **full stomach** (risk for pulmonary aspiration).
- **Best avoided:** in anticipated **difficult airway**.
- **RSI not needed in:**
 - Cardiac arrest.
 - Deeply comatose child.

SEQUENCE

Preparation
Pre-Oxygenation
Pre-treatment
Induction/Sedation
Paralysis
Protection/Positioning
Post-intubation

BEFORE RSI: ASSESS AIRWAY DIFFICULTY

DIFFICULTY AREA	SIGNS	
Positioning	Prominent/misshapen occiput, Short neck, Poor neck mobility	<ul style="list-style-type: none"> • If airway is difficult, AVOID RSI. (Can still use sedated intubation) • If RSI is necessary: <ul style="list-style-type: none"> ○ Call PICU/ anaesthesia ○ Keep laryngeal mask airway or video laryngoscope ready.
Bag-mask ventilation	Facial anomalies, Facial trauma/burns	
Laryngoscopy	Small mouth/Mandible, Abnormal palate, Cannot fully open mouth, Large tongue	
Intubation	Signs of upper airway obstruction (Hoarseness, drooling, stridor)	

PREPARATION

- Wear your PPE /infection precaution measures.
- Begin **pre-oxygenation** (*described below*)
- Take focused history (SAMPLE) and targeted physical examination to:
 - Identify conditions that will predict **difficulty of bag-mask ventilation or intubation** (*described above*)
 - Identify conditions that will affect **choice of medications**, e.g:
 - CVS compromise, ↑ICP, bronchospasm, succinylcholine contraindications (*see induction part*)
- **Prepare** equipment and **TEST** them.
- Have a **plan B** in case of failure.

PRE-OXYGENATION

- Spontaneously breathing child: 100% FiO₂ by **Non-rebreather mask** (*at least for 3 min*).
- Apneic or inadequately breathing: 100% FiO₂ by **Bag-mask ventilation** with small tidal breaths.
- During sedation and paralysis: Consider **Apneic oxygenation** via NC at 1L/kg/min, Max 15L/min

PRETREATMENT

- Atropine: **NOT ROUTINELY RECOMMENDED**, you can use if:
 - Children ≤ 1 year (*reduces the risk of vagally induced bradycardia*)
 - Children ≤ 5 years receiving succinylcholine or > 5 years receiving a 2nd dose of succinylcholine.
- DOSE: 0.01 - 0.02 mg/kg IV/IM (max. 1 mg/dose)

INDUCTION / SEDATION

Hemodynamically <u>STABLE</u> patients	<u>UNSTABLE</u> patients
Options (<i>depends on the patient's condition</i>):	Avoid agents that have significant vasodilatory properties:
<ul style="list-style-type: none"> • Ketamine: <ul style="list-style-type: none"> ○ Best for: bronchospasm (<i>causes bronchodilation</i>)/unstable patients. ○ Don't use: <3 months, Ketamine allergy, ↑ICP with HTN ○ IV: 1 – 2 mg/kg - IM: 3 – 4 mg/kg ○ Side effects: ↑secretions, laryngeal spasms, hallucinations. 	<ul style="list-style-type: none"> • Options include: <ul style="list-style-type: none"> • Ketamine • Fentanyl
<ul style="list-style-type: none"> • Fentanyl: <ul style="list-style-type: none"> ○ Can be used in: unstable patients. ○ IV: 1 – 5 mcg/kg titrated gradually ○ Precaution: give over <u>30-60s</u> (to avoid respiratory depression and chest wall rigidity) 	
<ul style="list-style-type: none"> • Propofol: <ul style="list-style-type: none"> ○ Only used in stable patients. ○ Can be used alone in high doses or with ketamine. ○ IV: 1 – 3 mg/kg ○ Precaution: may lead to hemodynamic instability (↓BP) 	
<ul style="list-style-type: none"> • Midazolam: <ul style="list-style-type: none"> ○ Only used in stable patients. ○ Never used alone (<i>has no analgesic effect</i>) ○ Best for: stable status epilepticus with propofol. ○ IV: 0.1 – 0.3 mg/kg, (max. 10mg/dose) ○ Precaution: may lead to hemodynamic instability (↓BP, ↓CO) 	

PARALYTIC

<ul style="list-style-type: none"> • Succinylcholine: <ul style="list-style-type: none"> ○ IV: ≤ 2 years: 2 mg/kg , > 2 years: 1-1.5 mg/kg ○ IM dose: 4mg/kg ○ Contraindicated: Rhabdomyolysis (crush injuries), chronic neuromuscular disease or myopathy, CP with paralysis, 48-72 hours after burn, increased intraocular pressure, multiple traumas, history of malignant hyperthermia, or pre-existing hyperkalemia.
<ul style="list-style-type: none"> • Rocuronium: <ul style="list-style-type: none"> ○ IV: 1 mg/kg ○ IM: >3months: 1mg/kg single dose, > 1 - 6 years: 1.8 mg/kg single dose ○ Precautions: Has longer duration of action and not quickly reversible, so carefully consider in potentially difficult airway.

PROTECTION / POSITIONING

<ul style="list-style-type: none"> • Cervical spine injury: maintain head immobilization. • No cervical spine injury: head in sniffing position. • Cannot see glottis: gentle cricoid pressure. • Confirm placement with end-tidal CO2 and auscultation. 	POST INTUBATION <ul style="list-style-type: none"> • CXR • Ongoing sedation/analgesia (<i>depends on the patient's condition</i>) • Paralysis if indicated
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CENTRAL CYANOSIS

- In an infant / child with unrepaired TOF **OR** in an infant / child with BT shunt + **NO** BT shunt murmur on examination.
- In the following conditions:
 - During agitation, feeding, exercise, pain, fever, or hypovolemia.
 - In a child after exercise that improves upon squatting.

SUSPECT A TET SPELL

Examination Signs:

- Tachypnea
- Tachycardia
- Desaturation

- Irritable inconsolable infant / child
- Progressively worsening cyanosis
- Decreased intensity of heart murmur

Prolonged Tet spell:

- Loss of consciousness
- Seizure
- Cardiac arrest

- **KNEE-CHEST POSITION.** (*immediately*)
- Attach to cardiopulmonary monitor.
- Keep the child **CALM**.
- Give **Oxygen**.

If fails

IV cannula available

- **IVF bolus** 0.9% NS: 10-20 ml/kg
- **Give Sedation:**
 - **IV Morphine:** 0.1mg/kg/dose

(Repeat once after 3 minutes if needed)

No IV cannula

- **Give Sedation:**
 - **IM Morphine:** 0.1-0.2 mg/kg/dose
 - **SC Morphine:** 0.2 mg/kg/dose
 - **Nasal Midazolam** (*IV Midazolam is not recommended, it leads to ↓SVR + ↓BP, worsening the condition*)
- **Obtain IV/IO access**

(Repeat once after 3 minutes if needed)

If fails

- Can repeat **IVF bolus** 0.9% NS: 10-20 ml/kg – as needed
- **IV Morphine infusion:** 0.1-0.2 mg/kg/hr

CALL PICU FOR ADVANCED CARE AND POSSIBLE INTUBATION

- Consult **cariology**
- May **correct acidosis** (NaHCO_3)
- **IV beta-blockers bolus**
 - Propranolol 0.1 mg/kg/dose
- **IV phenylephrine bolus:**
 - Bolus dose 5–20 mcg/kg/dose followed by continuous infusion 0.1-0.5 mcg/kg/min.

Start with whichever is quicker to prepare

HYPERTENSIVE URGENCIES AND EMERGENCIES

Hypertension Definitions:

<13 years: systolic and/or diastolic BP \geq 95th percentile for age, gender, height upon on three or more occasions

\geq 13 years: $> 130/80$ upon three or more occasions

Hypertensive Urgency:

An acute severe elevation in BP **WITHOUT** life-threatening symptoms or evidence of acute target-organ damage.

Hypertensive Emergency:

1. BP elevated above stage 2 HTN

2. Acute severe symptomatic elevation in BP **WITH** evidence of potentially life-threatening symptoms or end organ damage.

Category	<13 yrs	\geq 13 yrs
Normal BP	<90th percentile for age, sex, and height	<120/<80 mm Hg
Elevated BP	90th–<95th percentile for age, sex, and height	≥ 120 / <80 - 129 / <80 mm Hg
Stage 1 HTN	≥ 95 th –95th percentile plus 11 mm Hg	130–139/80–89 mm Hg
Stage 2 HTN	≥ 95 th percentile plus 12 mm Hg	≥ 140 / ≥ 90 mm Hg

INITIAL STABILIZATION

1. Maintain airway, breathing and circulation
2. Confirm elevated BP (appropriate cuff size, measure BP in both arms and one leg, manual BP reading preferred)
3. Evaluate for end-organ damage (physical findings: retinal exam, cardiac heave, laterally displaced apex, LVH)
4. Identify conditions that alter initial blood pressure management (Increased ICP, drug ingestion, pheochromocytoma) and manage according to underlying cause
5. Treat hypertensive urgency or emergency (follow algorithm)

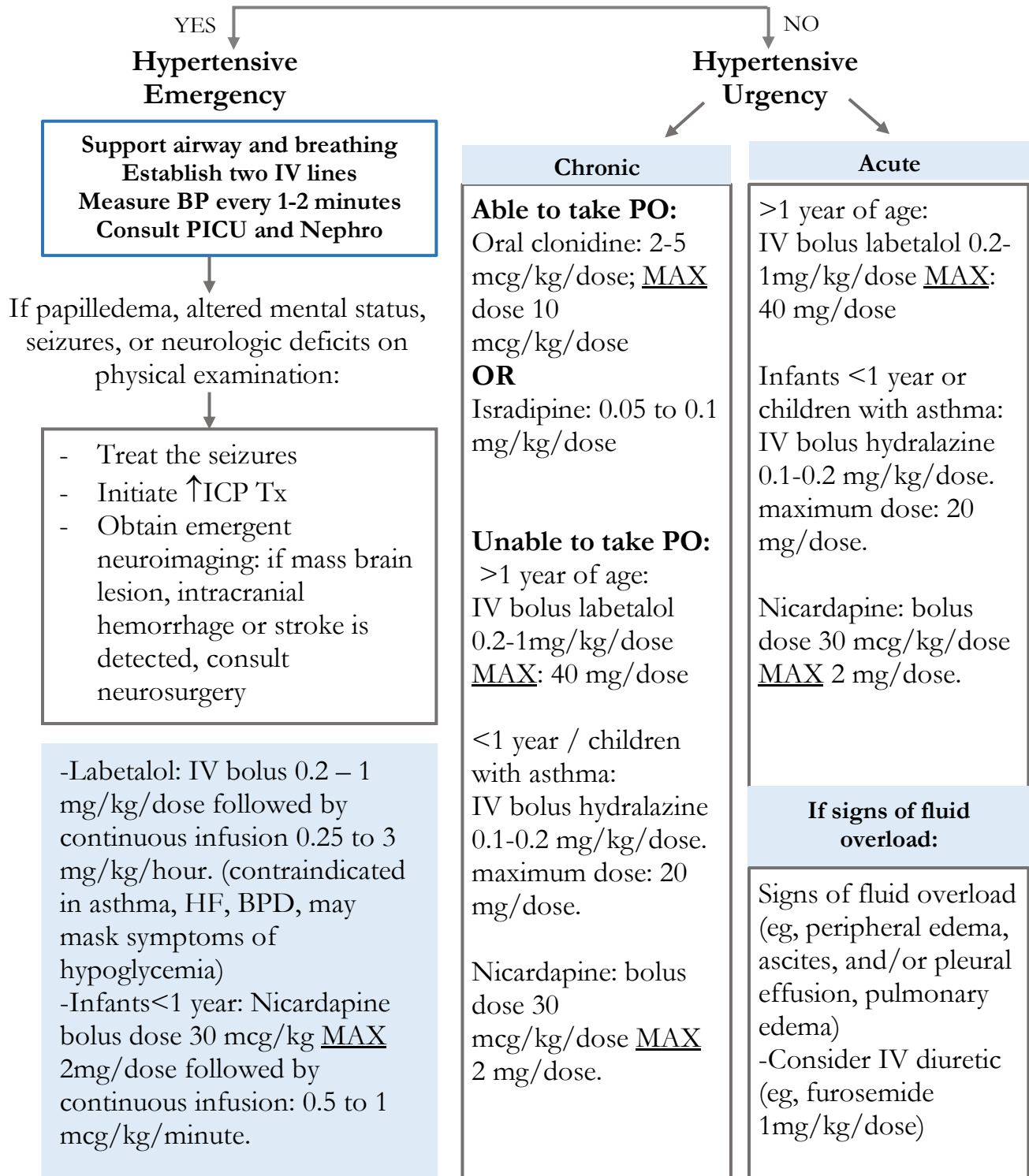
Note: If patient requires intubation, avoid use of ketamine - will elevate BP

INVESTIGATIONS

- BUN, creatinine, electrolytes, urinalysis, lipid profile
- Renal ultrasound: 1. If less than 6 years old, 2. Abnormal urinalysis, 3. Abnormal renal function
- Echocardiography and ECG
- Neuroimaging: if patient presents with headache or seizures
- Consider urine toxicology screen

Acute severe elevation of BP confirmed by repeated measurement (BP>30mmHg above the 95th percentile for age, sex, and height).

Signs of target-organ damage; ex: hypertensive encephalopathy, heart failure, renal disease



In hypertensive crisis due to an acute underlying condition: goal is to decrease BP by no more than 25% over the first 8 hours to avoid irreversible end organ damage. Further BP reduction should be gradual over 48 hours.

In hypertensive crisis due to a chronic underlying condition: goal is to decrease BP over 1-2 days.

Definition of Coma:

A state of unresponsive unconsciousness, caused by the dysfunction of the cerebral hemispheres bilaterally, the bilateral thalami and/or the brainstem

- No breathing and no pulse felt → start CPR. Refer to cardiac arrest algorithm
- No breathing and HR<60 with signs of poor perfusion → start CPR. Refer to bradycardia algorithm

- Start with ABCDE
- Provide 100% oxygen, intubate if necessary
- Connect to monitor, 12-lead ECG, check all vital signs
- If trauma suspected → Stabilize cervical spine
- Check RBS
- Establish IV access

Patient is hypoglycemic (RBS<3.9mmol/L)?

YES

NO

-Collect critical sample if RBS <2.8 mmol/L
-Start 2.5-5ml/kg bolus of dextrose 10% (slowly 2-3ml/min)
-Check RBS every 15-20 mins
-If RBS <3.9 mmol/L → repeat D10% bolus (Refer to hypoglycemia algorithm)

Conduct secondary survey → SAMPLE

Collect blood gas

Collect screening labs:

- CBC and coagulation profile
- LFT/RFT and S.Electrolytes
- Blood and urine cultures ± CSF if indicated
- Ammonia and lactate
- Metabolic and drug screen “as indicated”

Abnormal electrolyte or ↑ Ammonia?

Correct abnormal electrolytes
Refer to hyperammonemia algorithm

Empiric Treatment

**If suspected seizure
“convulsive or
nonconvulsive”**

Start IV lorazepam
0.1mg/kg (max
4mg/dose) over 1 min

Assess over 5 mins, if
seizure persists, repeat
previous steps
(Refer to status
epilepticus algorithm)

Consider EEG if
nonconvulsive seizure
suspected or dx unclear

Suspected ↑ICP

-Secure airway
-Rapidly treat hypoxia, hypercarbia,
hypotension, hypoglycemia
-Maintain Hb >7g/dL
-Elevate head of bed 15-30°, keep
head midline
-Maintain normal body
temperature
- Urgent neurosurgery involvement
-Consider dexamethasone,
anticonvulsants, sedation where
appropriate
-If signs of impending herniation:
IV mannitol 0.25-1g/Kg over 20-
30 min OR IV 3% saline 5ml/Kg,
hyperventilate to PaCO₂ 30-35
mmHg
-Treat underlying cause

**Suspected
Meningoencephalitis**

IV ceftriaxone
100mg/kg/day once
daily (max 2g/dose)
PLUS IV vancomycin
15mg/kg/dose every 6
hours
+/- IV acyclovir 10-
15mg/kg/dose every 8
hours
Do LP if no
contraindications*
Do NOT delay
antibiotics waiting for
LP

**Suspected
toxidrome/toxic
exposure**

Opioid antidote: IV
Naloxone: <5yrs or <20kg
0.1mg/kg/dose
Child >5yrs or >20kg
2mg/kg/dose
Organophosphate
antidote:
IV Atropine 0.05-
0.1mg/kg
IV Pralidoxime 20-
50mg/kg (Max 2g/dose)
Benzodiazepine
antidote:
IV Flumazenil 0.01mg/kg
(Max 0.2mg)

Toxidrome signs:

Opioid/ Benzodiazepine:

Bradycardia, hypotension, respiratory depression, hypothermia and small pupils

Organophosphate:

Bradycardia, small pupils, normal BP and temperature

Adjunctive therapy

- Keep normal Na level (refer to hypo- and hypernatremia algorithms)
- Correct acid- base imbalances
- Thermal regulation
- H2Blockers for stress ulcers
- Ophthalmic lubricant to protect the cornea
- Control agitation (sedative agents, refer to RSI algorithm for sedation)

Contraindications for LP

- Signs of ↑ICP →do head CT scan
- Hemodynamic instability
- Soft tissue infection at site of LP
- Bleeding disorders
 - Plt < 50,000
 - INR>1.4

Indications of a CT scan

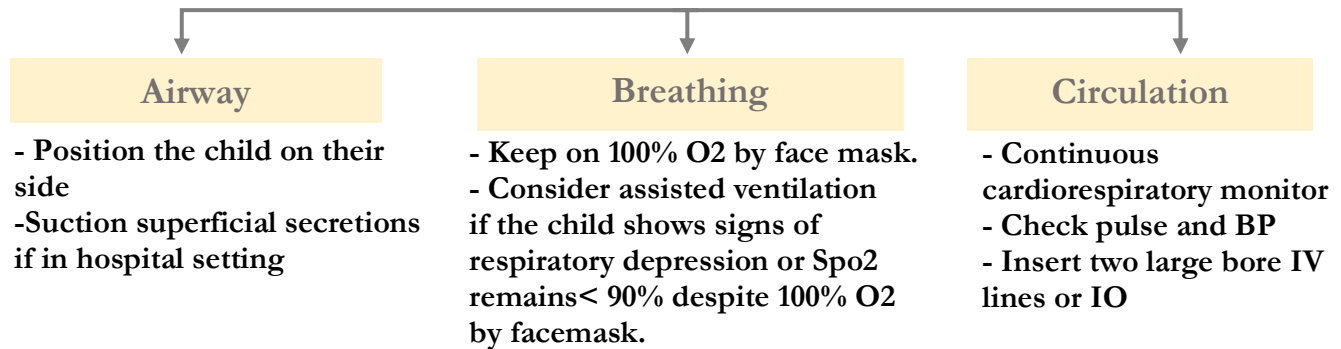
- Focal neurological signs
- Suspected trauma
- Bleeding disorders
- Signs of ↑ICP

Consider rapid MRI instead if available

Status Epilepticus

(For ages 3 months and above)*

Definition: Five minutes or more of continuous clinical and/or electrographic seizure activity or recurrent seizure activity without recovery (returning to baseline) between seizures.



Check glucose and temperature and adjust management as needed
Rule out meningitis and head trauma

1st line medication (first 5-15 min from seizure onset):

- Lorazepam IV 0.1 mg/kg (max 4 mg)
- OR
- Diazepam IV 0.3 mg/kg (max 5 mg if <5y and 10 mg >5yrs)
- OR
- Midazolam IV 0.1 mg/kg (max 5 mg)
IM 0.2 mg/kg (max 10 mg) buccal 0.5 mg/kg (max 10 mg)

If still seizing after 5 mins, repeat 1st line medication once. If >2 doses of 1st line were given, and the patient is still seizing after 5 mins then proceed to 2nd line.

Second line medications (15-25 min). Use any of the following:

Levetiracetam IV
60 mg/kg (max 3 g)
mixed with NS or
D5W given over 5
to 15 mins

OR

Phenytoin
IV 20 mg/kg (max 1g)
diluted in NS given
over 20 mins

Is the patient still seizing after 10-20 min?

Give a different 2nd line medication (If levetiracetam was initially used, then use phenytoin here) WITH a 3rd dose of benzodiazepine (high risk for respiratory depression)

OR

Phenobarbital
20mg/Kg IV, maximum
1g, diluted in NS or D5W
over 20 minutes

OR

**IV Midazolam infusion IN
PICU SETTING**

Still seizing?

Refractory Status Epilepticus (RSE)

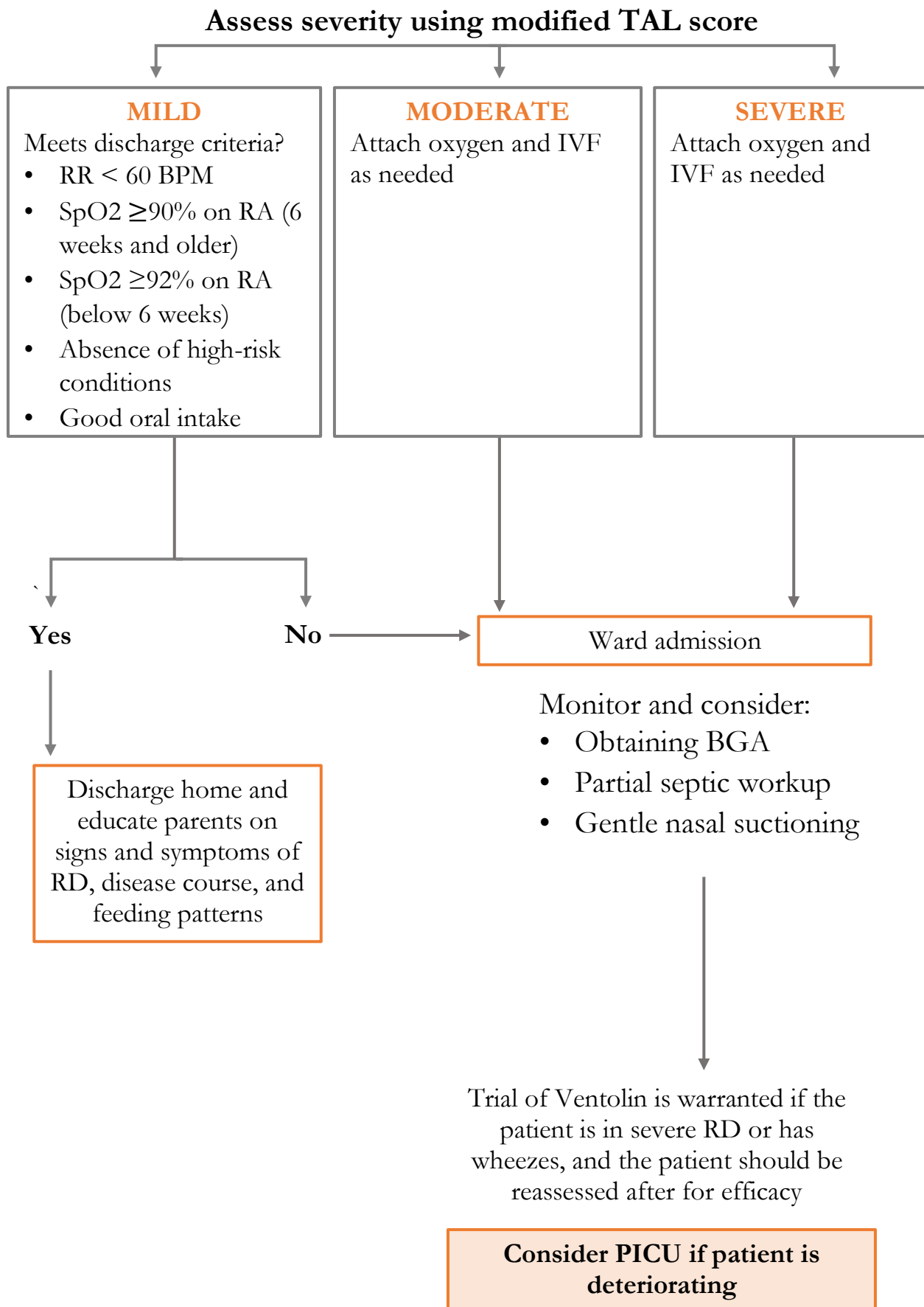
Consult PICU early

Consult Neurology

Prepare for advanced airway support early

Modified TAL score

Symptom	Assessment	Points
Respiratory rate	≤ 40 (≤ 30 if > 6 months)	0
	41-55 (31-45 if > 6 months)	1
	56-70 (46-60 if > 6 months)	2
	> 70 (> 60 if > 6 months)	3
Wheezing	None	0
	End expiratory	1
	Inspiration + expiration	2
	Audible without stethoscope	3
Cyanosis	None	0
	Peri-oral with crying	1
	Peri-oral at rest	2
	Generalized at rest	3
Accessory muscle use	None	0
	+	1
	++	2
	+++	3
0-3 = mild bronchiolitis 4-8 = moderate bronchiolitis 9-12 = severe bronchiolitis		



PRAM Score

Symptom	Assessment	Points
Suprasternal retractions	Not present	0
	Present	2
Scalene muscle retractions	Not present	0
	Present	2
Air entry	Normal	0
	Decreased at bases	1
	Widespread decrease	2
Wheezing	Absent	0
	Expiratory	1
	Inspiratory and expiratory	2
	Audible without stethoscope /silent chest with minimal air entry	3
Oxygen saturation	$\geq 95\%$	0
	92-94%	1
	$< 92\%$	2
< 3 = mild asthma 4-7 = moderate asthma 8-12 = severe asthma		

Evaluate by vitals and PRAM score. Attach O2 if SpO2 <92%

FIRST HOUR			
MILD (0-3 PRAM) <ul style="list-style-type: none"> Ventolin 2 doses 30 minutes apart then re-evaluate Consider oral steroids 	MODERATE (4-7 PRAM) <ul style="list-style-type: none"> Ventolin 2 doses 30 minutes apart + Atrovent 3 doses every 20 minutes Start oral steroids 	SEVERE (8-12 PRAM) <ul style="list-style-type: none"> Ventolin 2 doses 30 mins apart + Atrovent 3 doses every 20 mins, or consider continuous Ventolin nebulization Start IV steroids Keep on CP monitor NPO & IV line CXR + BGA Consider IV MgSO4 and PICU consult 	Impending respiratory failure <ul style="list-style-type: none"> Ventolin 2 doses 30 mins apart + Atrovent 3 doses every 20 mins, or consider continuous Ventolin nebulization Start IV steroids Keep on CP monitor NPO & IV line CXR + BGA Start IV MgSO4 Consider early call PICU for possible HFNC or NIV support.

SECOND HOUR			
MILD (0-3 PRAM) <ul style="list-style-type: none"> Observe for 1-2 hours, if still in mild category you may discharge with Ventolin SOS +/- steroids. 	MODERATE (4-7 PRAM) <ul style="list-style-type: none"> Ventolin 3 doses 20 minutes apart 	SEVERE (8-12 PRAM) <ul style="list-style-type: none"> Ventolin 3 doses 20 minutes apart Consider admission If no response, contact PICU 	Impending respiratory failure <ul style="list-style-type: none"> Transfer to PICU Consider reviewing the diagnosis for cases not responding to treatment

FOURTH HOUR AFTER STEROIDS			
MILD (0-3 PRAM) <ul style="list-style-type: none"> Discharge with Ventolin SOS +/- steroids. 	MODERATE (4-7 PRAM) <ul style="list-style-type: none"> Ventolin 3 doses 20 minutes apart Consider admission if not improving 	SEVERE (8-12 PRAM) <ul style="list-style-type: none"> Transfer to PICU Consider reviewing the diagnosis for cases not responding to treatment 	Impending respiratory failure <ul style="list-style-type: none"> Transfer to PICU Consider reviewing the diagnosis for cases not responding to treatment

DOSING

Ventolin: < 20 kg: 2.5 mg, > 20 kg: 5 mg

Atrovent: <20 kg: 250 mcg, >20 kg: 500 mcg

IV MgsO4: 50 mg/kg max 2 g, diluted in 30 ml NS

Prednisolone: 1-2 mg/kg max 60 mg

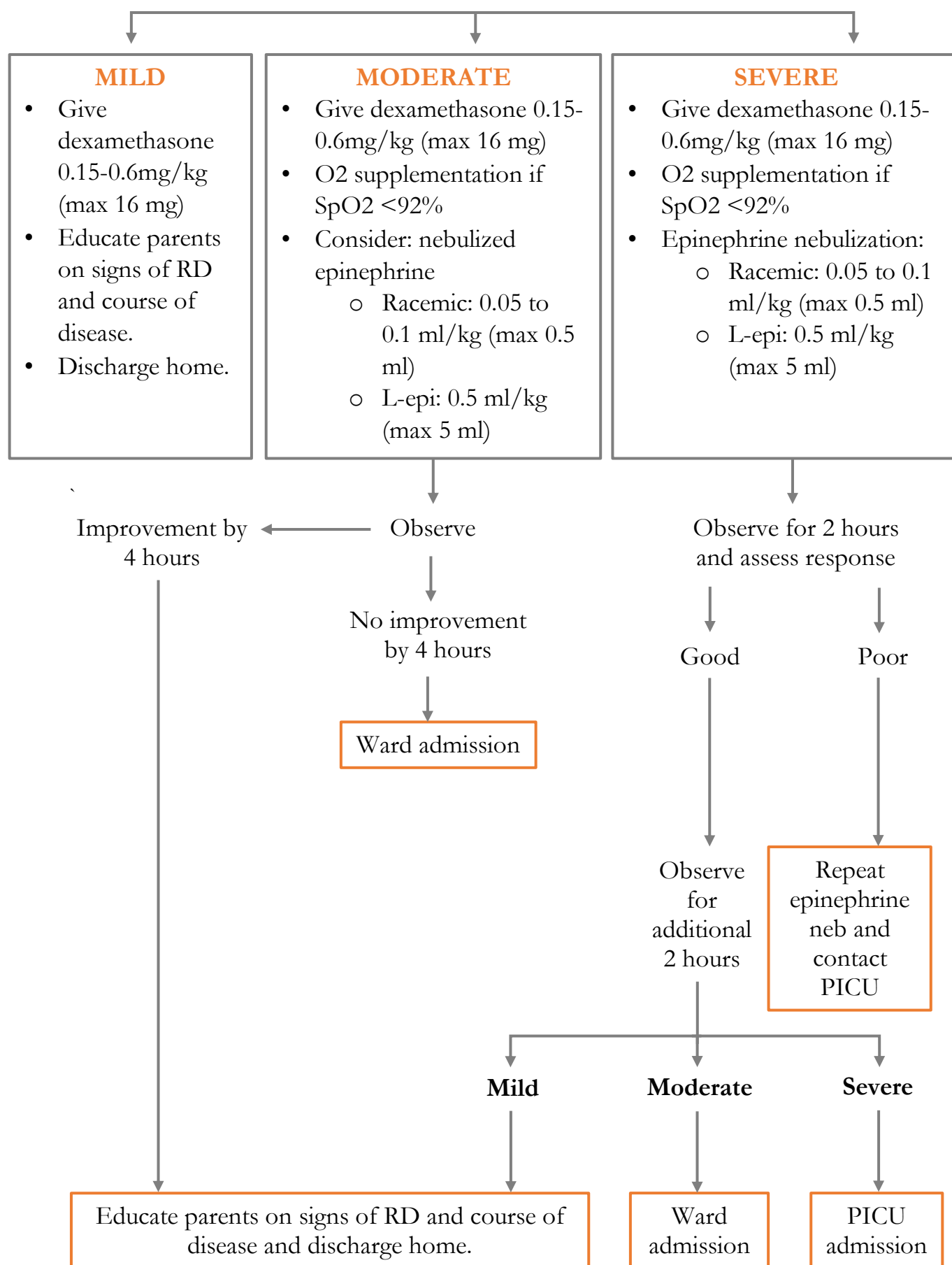
Dexamethasone: 0.3 – 0.6 mg/kg max 16 mg

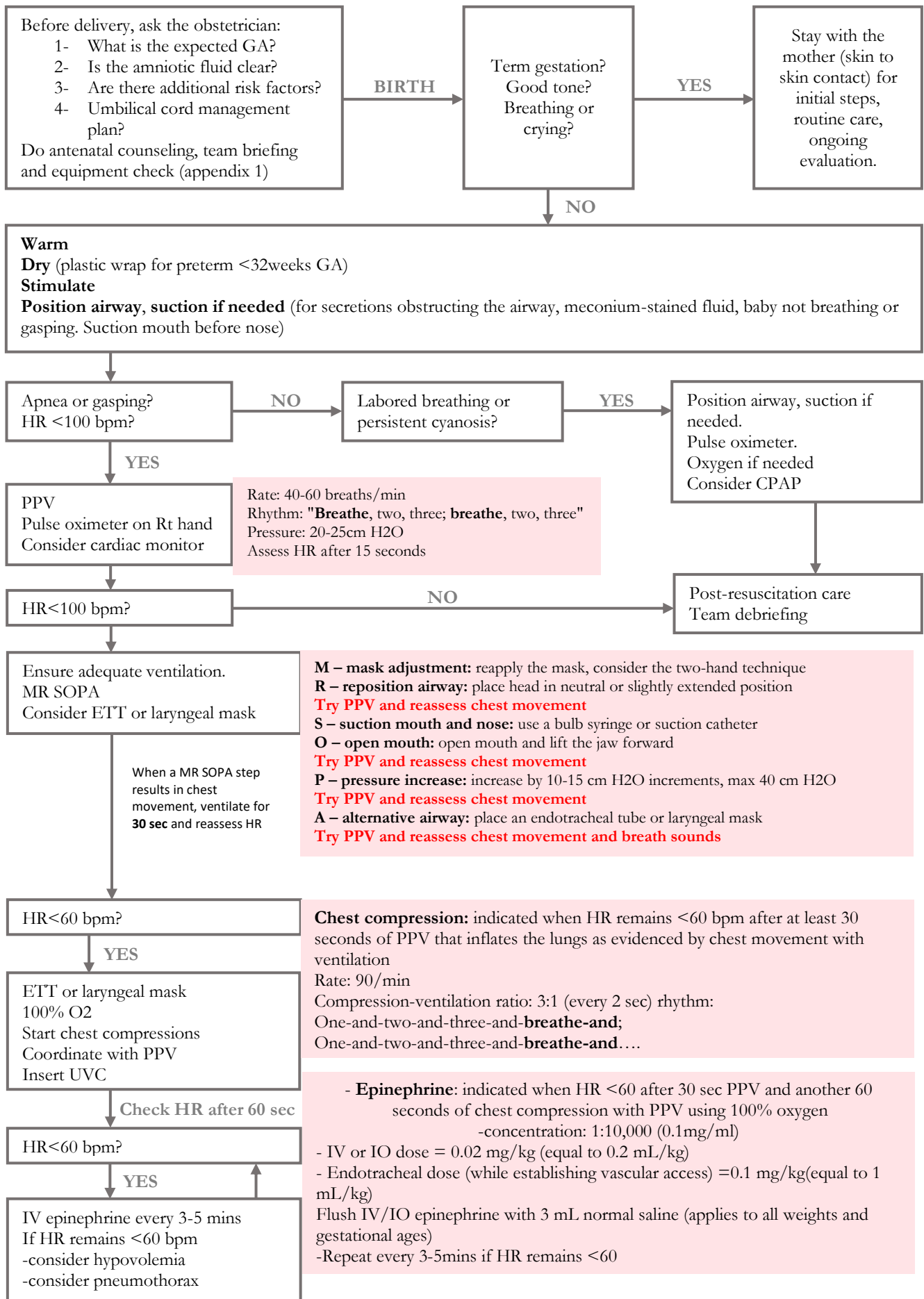
Methylprednisolone: 1-2 mg/kg divided BD max 60 mg

Westley Croup Severity Score

Symptom	Assessment	Points
Inspiratory stridor	Not present	0
	When agitated/active	1
	At rest	2
Intercostal recessions	Mild	1
	Moderate	2
	Severe	3
Air entry	Normal	0
	Mildly decreased	1
	Severely decreased	2
Cyanosis	None	0
	When agitated/active	4
	At rest	5
Level of consciousness	Normal	0
	Altered	5
Total possible score (17) <4 = mild croup 4-6 = moderate croup >6 = severe croup		

Croup diagnosed and severity assessment done by Westley Croup score





NRP Quick Equipment checklist

Warm	<ul style="list-style-type: none"> • Preheated warmer • Warm towels or blankets • Temperature sensor and sensor cover for prolonged resuscitation • Hat • Plastic bag or plastic wrap (<32 weeks' gestation) • Thermal mattress (<32 weeks' gestation)
Clear airway	<ul style="list-style-type: none"> • Bulb syringe • 10F or 12F suction catheter attached to wall suction, set at 80 to 100mmHg • Tracheal aspirator
Auscultate	<ul style="list-style-type: none"> • Stethoscope
Ventilate	<ul style="list-style-type: none"> • Flowmeter set to 10L/min • Oxygen blender set to 21% (21-30% if <35 weeks' gestation) • Positive-pressure ventilation (PPV) device • Term- and preterm-sized masks • 8F orogastric tube and 20ml syringe • Laryngeal mask (size 1) and 50ml syringe (if needed for inflation) • 5F or 6F orogastric tube if insertion port is present on laryngeal mask • Cardiac monitor and leads
Oxygenate	<ul style="list-style-type: none"> • Equipment to give free-flow oxygen • Pulse oximeter with sensor and cover • Target oxygen saturation table
Intubate	<ul style="list-style-type: none"> • Laryngoscope with size 0 and size 1 straight blades (size 00, optional) • Endotracheal tubes (sizes 2.5, 3.0, 3.5) • Carbon dioxide (CO₂) detector • Measuring tape and/or endotracheal tube insertion depth table • Waterproof tape or tube-securing device • Scissors
Medicate	Access to <ul style="list-style-type: none"> • Epinephrine (0.1 mg/ml = 1 mg/10ml) • Normal saline (100-ml or 250ml bag, or prefilled syringes) • Supplies for placing emergency umbilical venous catheter and administering medications • Table of pre-calculated emergency medication dosages for babies weighing 0.5 to 4 kg

Endotracheal Intubation

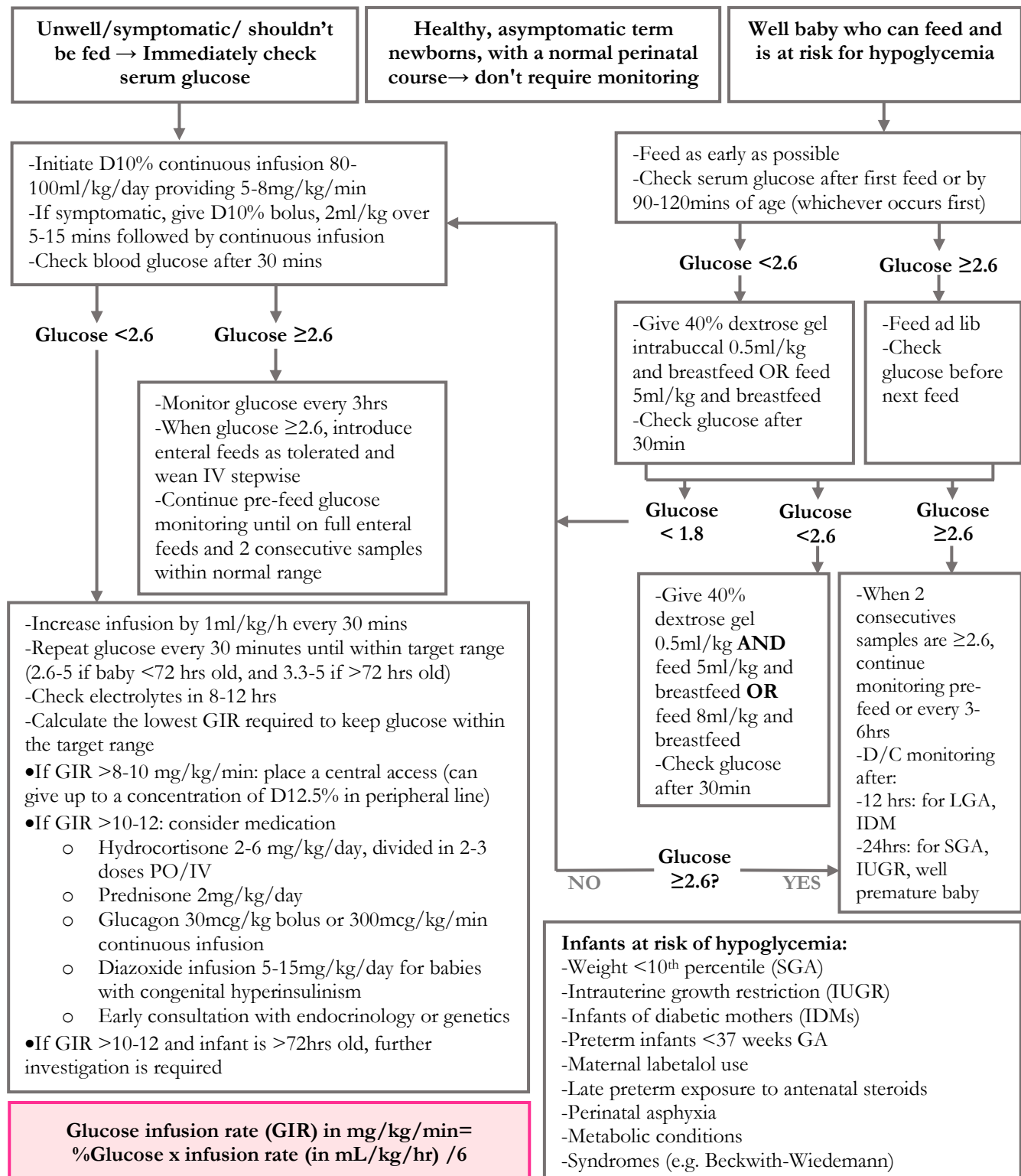
Gestation	ET Insertion Depth at lips (cm)	Approximate weight (kg)	ET size (ID, mm)
23-24 weeks	5.5	0.5-0.6	2.5
25-26 weeks	6.0	0.7-0.8	2.5
27-28 weeks	6.5	0.9-1.0	2.5-3.0
29-30 weeks	7.0	1.1-1.4	3.0
31-32 weeks	7.5	1.5-1.8	3.0
33-34 weeks	8.0	1.9-2.4	3.5
35-36 weeks	8.5	2.5-3.1	3.5
37-38 weeks	9	3.2-4.2	3.5-4.0

Target Oxygen Saturation Table	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%
Initial oxygen concentration for PPV	
≥35 weeks' GA	21% oxygen
<35 weeks' GA	21%-30% oxygen

Definitions: Blood glucose level <2.6 mmol/L in the first 72 hrs of life (transitional hypoglycemia)
Blood glucose level <3.3 mmol/L after 72 hrs (persistent hypoglycemia)

Signs of hypoglycemia: jitteriness/tremor, cyanotic episodes, convulsions, intermittent apneic spells or tachypnea, weak or high-pitched crying, limpness/lethargy, difficulty feeding, eye rolling, sweating, sudden pallor, hypothermia, cardiac arrest and failure

RBS<2.8mmol/L beyond 72 hrs→ collect critical sample



Prolonged Jaundice

>14 days (GA \geq 37 weeks)

>21 days (GA <37 weeks)

History, Examination, and Investigations

- Review newborn screening test
- Look for pale stool/dark urine
- Take feeding history
- Measure conjugated bilirubin: If $>17 \mu\text{mol/L}$ = abnormal (neonatal cholestasis)
- Investigations:
 - CBC + Retics +Blood film
 - Blood group (mother and baby)
 - DAT (Coombs)
 - Total and direct bilirubin
 - Albumin
 - G6PD screen
 - TFT
 - If prolonged jaundice:
 - Cultures: blood, urine +/- CSF if infection is suspected
 - +/- U/S abdomen
- If conjugated bilirubin is elevated, contact pediatric gastroenterologist/surgeon

Baby has suspected /obvious jaundice

- 1) **Measure serum bilirubin**
 - Can use transcutaneous bilirubin (TcB) in babies ≥ 35 weeks GA and >24 hours old, if TcB level $>250 \mu\text{mol/L}$ or within 50 $\mu\text{mol/L}$ of PT threshold \rightarrow measure serum bilirubin
- 2) **Interpret result using threshold table and graph**
- 3) **Urgent review within 6 hours to exclude pathological causes**
- 4) **If no treatment required, continue to measure serum bilirubin until level is both:**
 - Below the treatment threshold
 - Stable/and or falling

Risk factors for developing significant hyperbilirubinemia (requires closer monitoring)

- Prematurity*
 - Hemolytic disorders*
 - Early onset jaundice (24 hrs)*
 - Predischage bilirubin close to phototherapy threshold
 - Phototherapy before discharge
 - Parent/ sibling required treatment for neonatal jaundice
 - Family history suggestive of inherited hemolytic disorder
 - Bruising, cephalohematoma, or internal bleeding
 - Macrosomia in a newborn of a diabetic mother
 - Down syndrome
 - Exclusive breastfeeding with suboptimal intake
- *at risk of rebound*

Risk factors for Neurotoxicity

- Gestational age <38 wk, and risk increases with the degree of prematurity
- Albumin $<3.0 \text{ g/dL}$ (30 g/L)
- Isoimmune hemolytic disease, G6PD deficiency, or other hemolytic conditions
- Sepsis
- Significant clinical instability in the past 24 hrs



Use special chart with lower thresholds!

PHOTOTHERAPY

Start when:

- TSB at/above threshold of PT
- Near threshold ($<34 \mu\text{mol/L}$ below PT level) if:
 - Early onset jaundice (1st 24 hrs)
 - ABO incompatibility
 - Rapidly rising bilirubin levels ($\geq 5 \mu\text{mol/L/hr}$)
 - Significant

During PT:

- Monitor vitals, input /output chart
- Repeat serum bilirubin 4-6hrs after initiating PT, then every 6-12hrs when level is stable or falling (expected response: decrease by $34-50 \mu\text{mol/L}$ in 4-6hrs)
- Encourage breastfeeding. Provide supplemental feeds if inadequate intake, excessive weight loss ($>10\%$ of BW)
- IV fluids for babies at risk of progression to level of exchange, hypovolemia, hyponatremia, dehydration. Bolus $10-20\text{ml/kg}$, maint: D10% with $1/4\text{NS}$, rate $60-80\text{ml/kg/day}$ (babies 24 hrs old), $80-100\text{ml/kg}$ (babies $\geq 48\text{hrs}$ old)

ESCALATION OF CARE

Use continuous multiple/intensive PT if:

- Bilirubin level is rising rapidly ($>5 \mu\text{mol/L/hr}$ or $120 \mu\text{mol/L/day}$) in the first 24 hrs or ($>3 \mu\text{mol/L/hr}$ or $72 \mu\text{mol/L/day}$) thereafter
 - Bilirubin level is at level within $35 \mu\text{mol/L}$ below the threshold of exchange transfusion
 - If level fails to respond to single PT within 6 hrs of starting PT
- Collect blood for type and cross match and consult neonatologist for an exchange transfusion
- IV hydration
- Measure TSB every 2 hours
- Step down to double PT if level falls 50 below threshold for exchange transfusion

IVIG

0.5-1 g/kg over 2-4 hours as adjunct to continuous multiple PT in case of:

- Rhesus haemolytic disease
- ABO haemolytic disease
- Immune haemolytic jaundice when serum bilirubin continues to rise by $>8.5 \mu\text{mol/L/hr}$
- If TSB is within $34 \mu\text{mol/L}$ of the threshold for exchange transfusion

EXCHANGE TRANSFUSION

Used when:

- Bilirubin level at/above threshold level of exchange transfusion
- There are clinical features and signs of acute bilirubin encephalopathy (lethargy, hyper or hypotonia, poor suck, high pitched cry, recurrent apnea, opisthotonos, retrocollis, seizures)
- Use a double volume exchange exchange transfusion (term baby: $2 \times 80\text{ml/kg}$), (preterm: $2 \times 100\text{ml/kg}$)
- Continue on multiple continuous PT, give IVIG while preparing for exchange
- Measure bilirubin within 2 hours following transfusion

Stop phototherapy when:

- Serum bilirubin falls to a level at least $50 \mu\text{mol/L}$ below PT level
 - Serum bilirubin $<205 \mu\text{mol/L}$ for babies at risk of rebound
- Check for rebound within 12-24 hrs after stopping PT
- For babies at risk of rebound*, check level within 6-12hrs

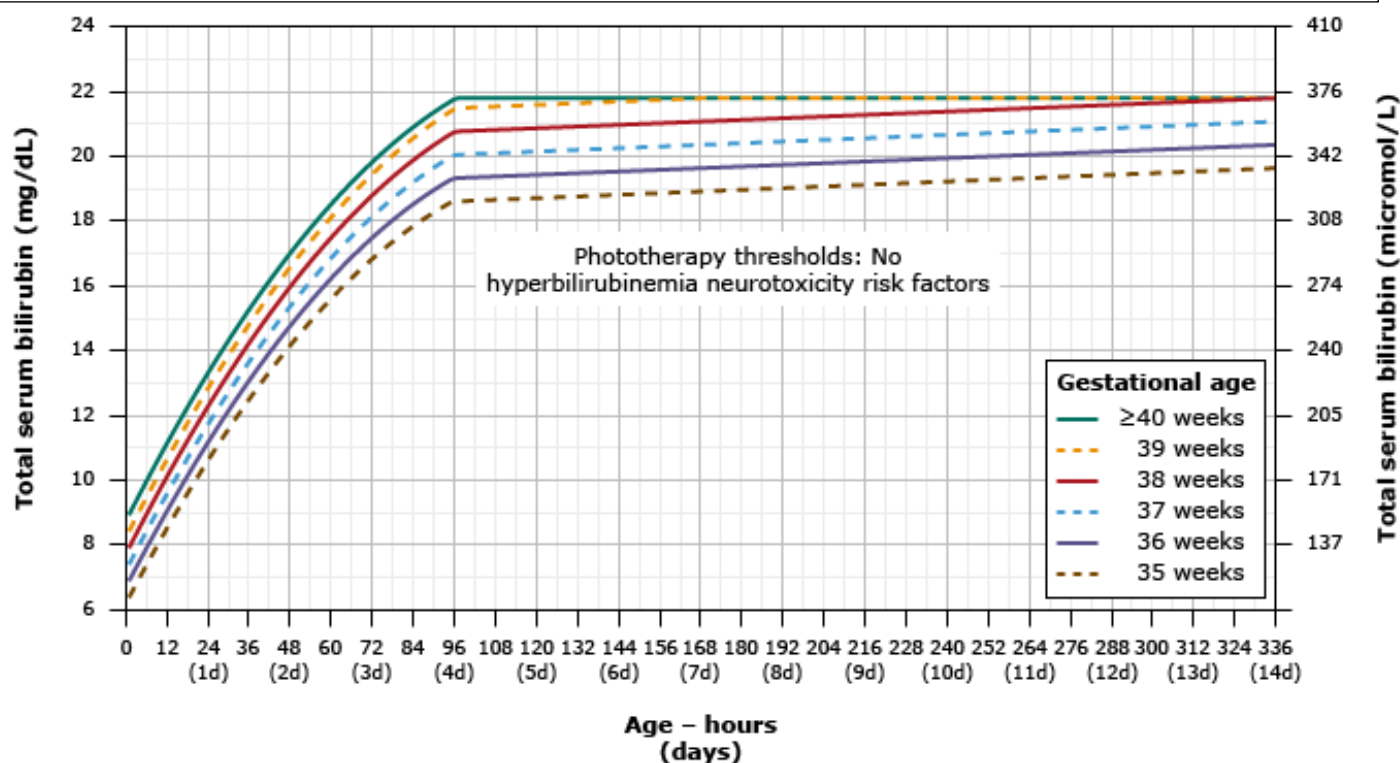
Follow up TSB after discharge:

Use the difference between the bili level and PT threshold to determine the interval of follow up:

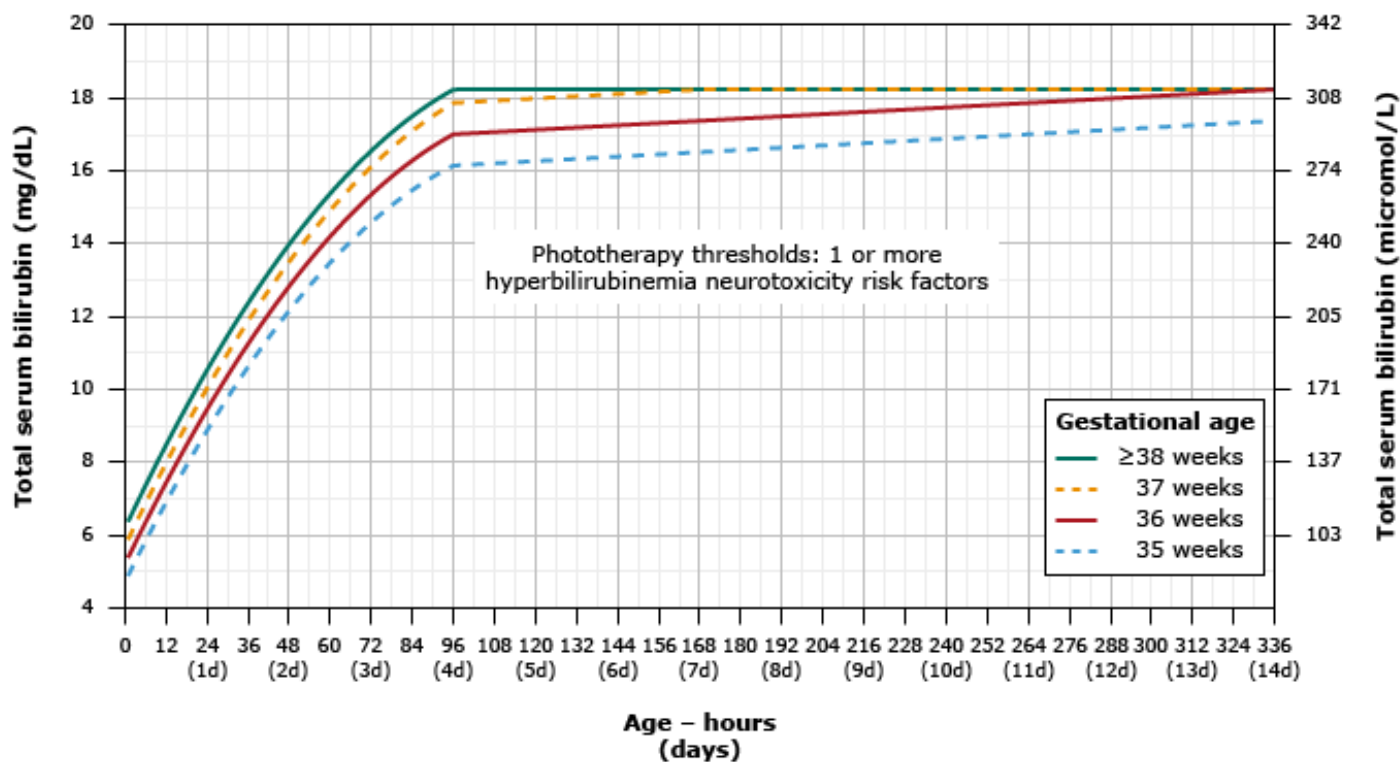
PT threshold minus TSB/TcB	Discharge recommendations
$34-58 \mu\text{mol/L}$	TSB or TcB in 4- 24 hrs
$59-92 \mu\text{mol/L}$	TSB or TcB in 1-2 days
$>92 \mu\text{mol/L}$	Clinical judgement

Phototherapy Levels

Hour-specific thresholds for phototherapy in newborns ≥ 35 weeks gestation with unconjugated hyperbilirubinemia in the absence of neurotoxicity risk factors (other than GA)



Hour-specific thresholds for phototherapy in newborns ≥ 35 weeks gestation with unconjugated hyperbilirubinemia and one or more neurotoxicity risk factors

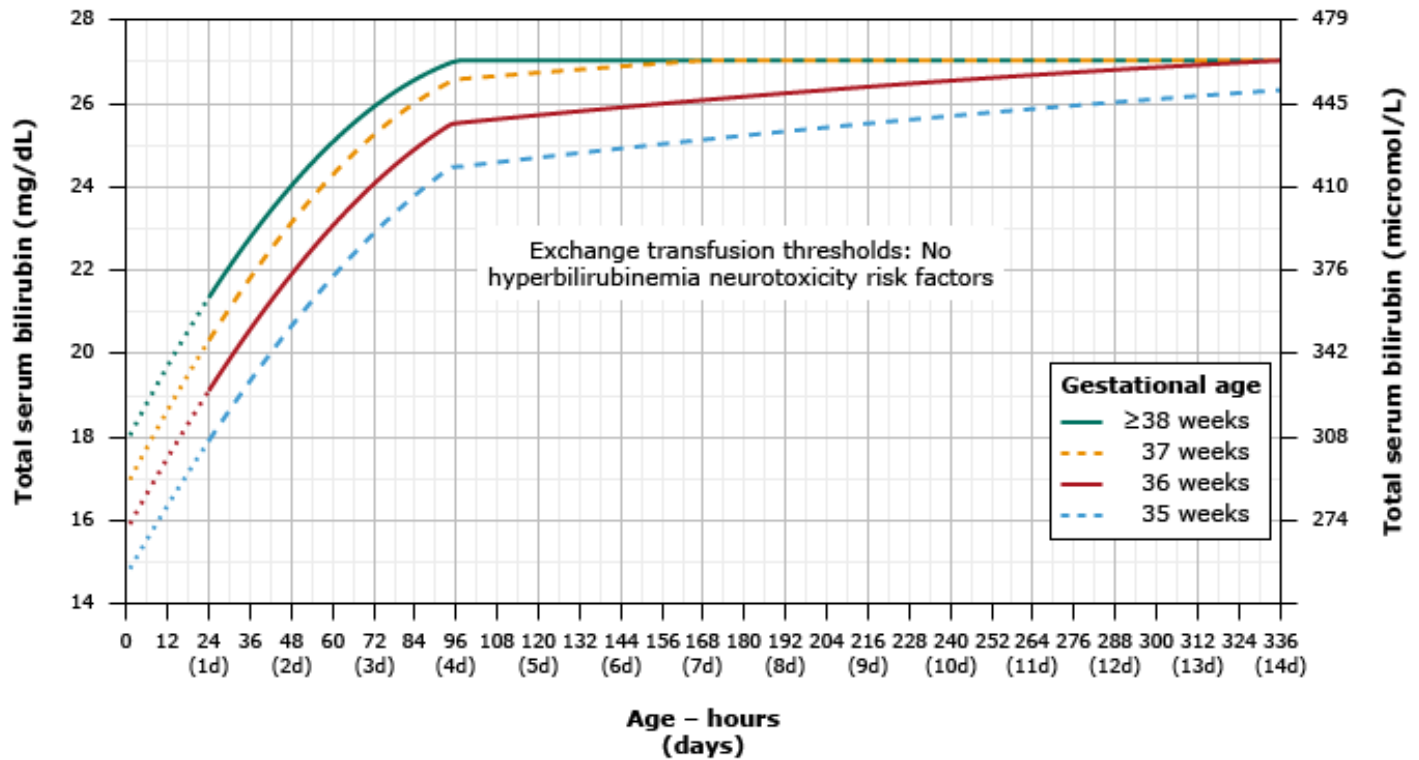


An approximate way to convert $\mu\text{mol/L}$ to mg/dL : divide by 17

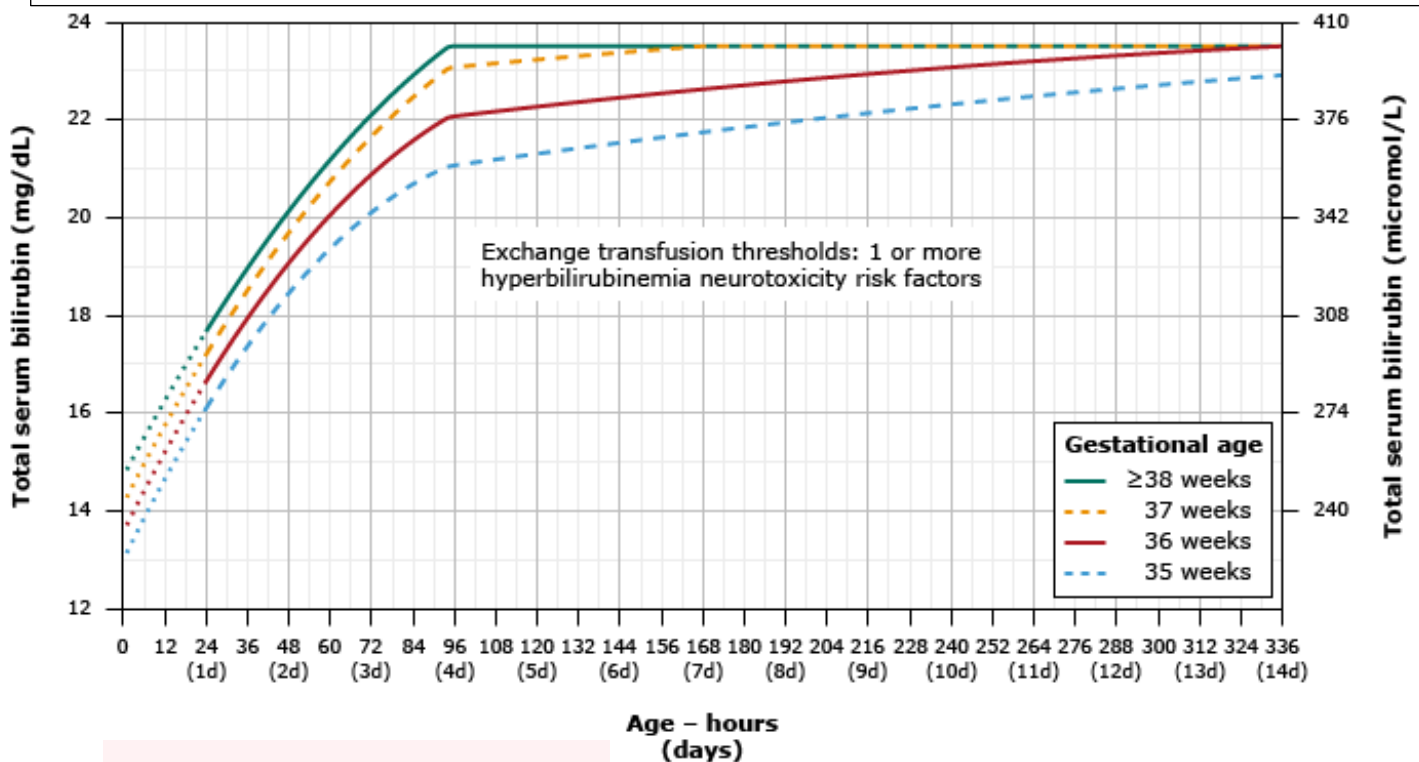
Continued

Exchange Transfusion Levels

Hour-specific thresholds for exchange transfusion in newborns ≥ 35 weeks gestation with hyperbilirubinemia in the absence of neurotoxicity risk factors (other than GA)



Hour-specific thresholds for exchange transfusion in newborns ≥ 35 weeks gestation with hyperbilirubinemia and one or more neurotoxicity risk factors



An approximate way to convert $\mu\text{mol/L}$ to mg/dL : divide by 17

Signs of acute decompensation

Poor feeding, lethargy, vomiting, shock, seizure, dystonia, coma, apnea, rapid breathing, hypoglycemia, BRUE

ABCs first

- If in shock: IVF 20 ml/kg NS bolus and repeat as needed
- Hypoglycemia: 2-5 ml/kg D10 bolus then start maintenance
- Start antibiotics
- Admit to the hospital
- PICU consultation if in shock or in need of respiratory support
- Metabolic team consultation

Fluid management

- D10% with 0.45-0.9 NS (rate 1.5 maintenance) to keep GIR 8-10 mg/kg/min.
- Add KCL as needed
- Maintain GIR 8-10 mg/kg/min
- Maintain BS 5- 8 mmol/l
- If BS > 10 start insulin infusion 0.05-0.1 u/kg/hr

For persistent acidosis (after correction of perfusion)

If $\text{HCO}_3^- \leq 15$

- Use IV NaHCO_3 (8.4%)
- HCO_3^- deficit (mEq) = $\text{Wt (kg)} \times 0.6 \times (22 - \text{current } \text{HCO}_3^- \text{ in mEq})$, dilute each 1 ml of HCO_3^- in 4 ml of water.
 - o you may multiply weight by 0.3 if mild, or 0.6 if mod-severe
- Administer half of the calculated dose initially as a slow bolus over 1-2 hrs, and the remaining half dose over 6 hrs.
- Target HCO_3^- : any value above 20-22 mEq
- Monitor PH, HCO_3^- , glucose, and electrolytes.

TRIGGERS

- Fever
- Infection
- Trauma
- Surgery
- Fasting
- Increased intake of protein, sugar, or fat

Investigations

Blood: CBC, BGA, anion gap, electrolytes, urea and creatinine, serum glucose, ammonia, lactate, LFT, coagulation, profile, CK, uric acid, carnitine and acylcarnitina, plasma a.a, pyruvate
Urine: ketones, pH, R/M, C/S, organic acids, myoglobin, reducing substance

DIALYSIS

Indications: intractable metabolic acidosis, coma, severe electrolyte disturbances, intractable hyperammonemia

COFACTORS

Mitochondrial cocktail (note that doses are variable to use)

Biotin 10 mg OD PO

Riboflavin 100 mg TDS

Carnitine 100 mg/kg/ day Q 6 H IV/PO

Co enzyme co 30 mg/kg/ day divided TDS. (Only in genetically confirmed deficient cases)

Thiamine 100 mg TDS

NUTRITION

- Stop protein for 24—36 hours for UCD
- Start intralipid 1-2 g/kg/day (avoid in FAOD)
- Gradual introduction of proteins and essential A.A after 24-48hrs

MONITOR

- GCS
- Vitals
- BP
- Hydration
- RBS
- BGA
- Electrolytes
- Urea and RFTs

AVOID

- Ringer's lactate
- Steroids
- Valproic acid

If hyper-ammonemia: Refer to hyper-ammonemia algorithm

Ammonia level: neonate > 150 $\mu\text{mol/L}$, infants > 100 $\mu\text{mol/L}$.

Clinical Features

→ Poor feeding, lethargy, tachypnea, hypothermia, irritability, vomiting, ataxia, seizures, hepatomegaly, coma.

- | | |
|----------|---|
| A | Connect to cardiorespiratory monitor, connect to O ₂ , IV access, check RBS. |
| B | Contact metabolic specialist |
| C | Consider PICU consultation |

Confirm the diagnosis: Repeat the ammonia sample by taking a free flowing sample, place on wet ice and send urgently to the lab after informing them about an urgent sample being sent

Investigations: BGA, lactate, RFT, LFT, coagulation profile, plasma amino acids, urine organic acids, acylcarnitine, urine orotic acid, cultures (blood, urine and, if indicated, CSF), pyruvate (only if the first lactate is high and make sure another sample for repeat lactate is taken)

Initial management

- Stop all protein intake and keep NPO. (Avoid withholding protein > 48hrs)
- If the patient is dehydrated, give a bolus of NS 10-20 ml/kg. (Monitor GCS, & signs of brain edema; note: no benefit for mannitol)
- IVF D12.5% + 0.45% NS at 1.5 maintenance rate (check cardiac status prior to IVF initiation)
- Start IV intralipid (preferably by central line) if the patient is NPO > 24 hours: 1-2 g/kg to meet the calories needed (80-130 Kcal) **Given ONLY if acylcarnitine profile RULES OUT FAOD.**
- Broad spectrum antibiotics.

IV ammonul (sodium benzoate/ sodium phenylacetate).

Before starting, please consult a metabolic specialist.

1 ml of ammonul = 100 mg of sodium benzoate and 100 mg of sodium phenylacetate

100 mg of ammonul = 30.5 mg of Na (1.33 mEq of sodium)

Dilute ammonul in D10% to a concentration of 10mg/ml.

Initial therapy: Infusion over 90 min to 2 hours.

Weight 0-20 kg: 2.5 ml/kg diluted in 25 ml/kg of D10% over 2 hours.

Weight > 20 kg: 55 ml/m² diluted in 25 ml/kg of D10% over 2 hours.

- In cases of CPS or carnitine deficiency: add arginine 10% → 250 mg/kg
- In cases of ASS and ASL deficiency: add arginine 10% → 600 mg/kg
 - o Max dilution of ammonul: 700-750 ml to be given over two hours
- In cases where urea cycle defect is diagnosed: contact metabolic specialist to adjust arginine dose

Maintenance: (Use central line, unless emergency necessitates use of peripheral line)

Weight 0-20 kg: 2.5 ml/kg diluted in 25 ml/kg of D10%, over 24hrs.

Weight > 20 kg: 55 ml/m² diluted in 25 ml/kg of D10%, over 24 hrs.

Adverse effects of ammonul: vomiting, acidosis, agitation, brain edema, convulsions, hyperglycemia, hypocalcemia, hypotension.

Monitor:

1- Ammonia: Q 3-4 H

2- Glucose:

- Maintain a blood sugar between 5-10 mmol/L
- If blood sugar is > 10, consider adding insulin at a dose of 0.1 units/kg/hour and titrate until blood sugar is controlled.

Medications to avoid:

- Steroids
- Valproic Acid
- Haloperidol

Other:

- IV Zofran with infusion of ammonul to avoid vomiting
- Consider hemodialysis if ammonia level is >300 (>200 in adults)
- Before discontinuing the ammonul infusion, confirm an ammonia level of <100 and start oral ammonia scavengers 4 hours prior to stopping the infusion
 - Make sure the patient is tolerating oral feeds before shifting to oral medication
- Monitor ammonia Q 6-12 hr.
- Cover the patient with broad spectrum antibiotics and make sure the patient has an optimum caloric intake

Other ammonia scavengers in hyperammonemia:

- Carglumic acid (Carbaglu in case of NAGS deficiency) : 100-200mg/kg as **a loading dose, then 250 mg/kg/day** .
- IV/PO arginine (**DO NOT USE IN ARGININE DEFICIENCY**) loading dose 200 mg/kg (2 ml/ kg) over 2 hours (concentration 100 mg/ml) **then 200-600 mg/kg/24 (2 ml - 6 ml/kg/24hr) (concentration 100mg/ml).** **Can be given through the same line with ammonul**

Any patient known to have a metabolic disorder needs to be seen ASAP

(Very long chain AcylCoA dehydrogenase deficiency)

Presentation: fever, vomiting, lethargy, weakness

- 1- Check RBS by glucometer immediately
- 2- Insert IV line(s)
- 3- Urgent labs

If hypoglycemia (RBS <2.6-2.8)

Neonate: 2 ml/kg D10% bolus

Children beyond neonatal period: 5-10 ml/kg D10% bolus

Then keep on 1.5 maintenance 0.45% or 0.9% NS +D12.5%

Urgent labs:

RFT, LFT, serum glucose, electrolytes, CK

Urine r/m

BGA, ammonia, lactate (arterial sample is preferred)

Partial septic if indicated

ECG if needed

If newly diagnosed, or abnormal newborn screen, order acylcarnitine profile on filter card

Start IVF

Infants: D12.5% + 0.45% or 0.9% NS (1.5 x maintenance)

Children : D12.5% + $\frac{1}{2}$ NS (1.5 maintenance)

-Add 10-20 mEq/L of KCL as needed

-Intralipids are contraindicated

Complications:

- Hypoketotic hypoglycemia
- Rhabdomyolysis
- Metabolic acidosis
- Liver dysfunction
- Reye-like syndrome
- Cardiomyopathy
- Sudden death

- If high CK >> admit and continue IVF
- If high ammonia >> refer to hyperammonemia algorithm
- If symptoms of cardiomyopathy >> consult cardiologist and consider PICU

If bicarbonate is below or equal 15 mEq, sodium bicarbonate IV may be used (after ensuring adequate hydration)

Start feeding as soon as possible, and avoid fasting

ALWAYS CONSULT THE METABOLIC TEAM

DEFINITION

Preterm+BWT<1.5kg: total serum Ca <1.75 mmol/L (<7 mg/dL), ionized Ca <1 mmol/L (<4 mg/dL)

Term+BWT>1.5kg: total serum Ca <2 mmol/L (<8 mg/dL), ionized Ca <1.1 mmol/L (<4.4 mg/dL)

In children: Total serum Ca <2.1 mmol/L (<8.5 mg/dL)

Note: measuring total serum calcium can be misleading, and ionized calcium is preferentially used in assessment and to guide management

Investigations

- Serum: total Ca, ionized Ca, Mg, Phos, SUE & Gluc, Albumin, PTH, 25-OH Vitamin D, ALP
- Urine: Ca, Mg, Phos, Creatinine
- ECG: for prolonged QT
- Monitor BP for hypotension

Symptoms & Signs

Tetany & neuromuscular irritability (paresthesia, twitching, carpopedal spasm, laryngospasm, bronchospasm, seizure), weakness, irritability, Trousseau's sign, Chvostek's sign, low BP

Most hospitals are correcting once Ca <2 mmol/L [follow your hospital protocol]

SYMPTOMATIC HYPOCALCEMIA

IV Ca gluconate 10% (BOLUS):

- Dilute 1–2 ml/kg of a 10% calcium gluconate in 2% solution (1:4 cc NS or D5%) then give 1–2 ml/kg over 10–20 minutes [max 20ml/dose]
- Cardiopulmonary monitor and ECG (if HR<70 stop immediately and reassess)
- Check cannula site Q1-2h (if any signs of extravasation, burns or calcifications; stop immediately)
- Add Vit D supplementation
- Measure serum Ca Q6h & repeat bolus accordingly (second bolus may be given in an hour)
- If Ca level is improving and asymptomatic continue with the infusion and recheck Ca

IV Ca gluconate 10% (INFUSION):

- Dilute 1-2 ml/kg of Ca gluconate 10% in 2% solution (1:4 cc NS or D5%) then give 1-2 ml/kg/hr until you reach the set target
- Re-check Ca Q6h
- Once corrected to 2 mmol/L, reduce infusion by 50% (never stop immediately). If it reaches 2.2 mmol/L, stop infusion and continue oral Ca

Switching to ORAL SUPPLEMENTATION:

- Start oral Ca gradually once infusion reduced by 50% and continue with full dose once infusion is stopped **OR** start once infusion is stopped
- Start Vit D (One-alpha drops) along with oral Ca

ASYMPTOMATIC HYPOCALCEMIA

Oral Calcium: 50-150 mg/kg/day elemental Ca divided in 4-6 doses [max 1g/day] + Vitamin D

In Kuwait: Calsyr Syrup (Ca glubionate): 5 ml/ 109.3 mg elemental Ca

Don't forget to correct hypomagnesemia (Mg <0.6 mmol/L) if present: give MgSO4 50% IV/IM 0.2 ml/kg/dose or 25-50mg/kg/dose SLOWLY (max 4ml per dose, or 2 g per dose). Hypocalcemia may not be corrected unless you correct Mg levels.

Dosing

Ca Gluconate

[1ml Ca gluconate 10%= 0.223 mmol= 0.48 meq = 10 mg elemental Ca]

[1ml Ca gluconate 2% =0.045 mmol = 0.096 meq = 2 mg elemental Ca]

Mg Sulfate

[1 mmol = 2 mEq = 24 mg of elemental magnesium = 240 mg magnesium sulfate] or [1g=4 mmol]

Vit D (1,25-dihydroxyvitamin D)

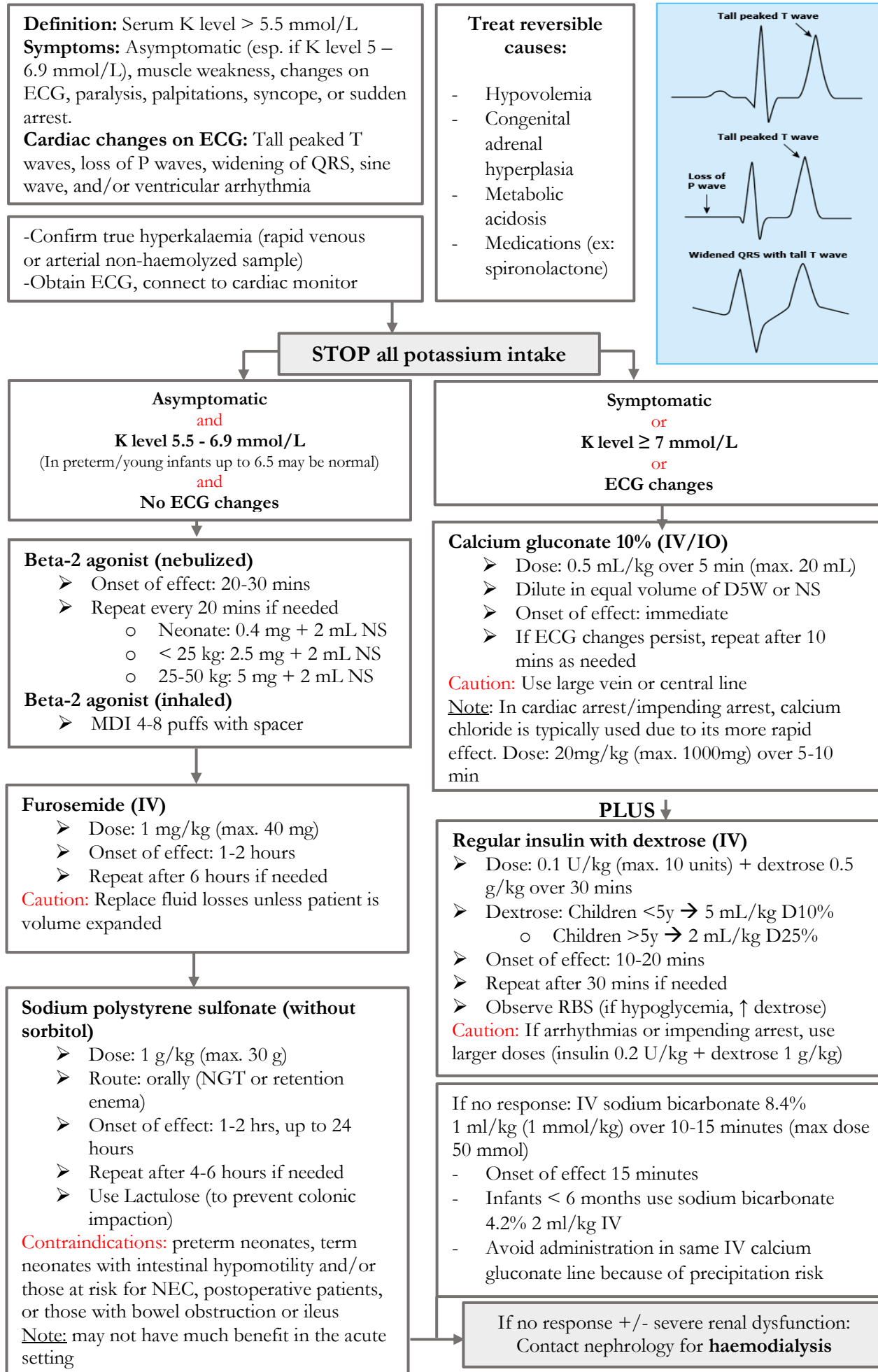
0.05 mcg/kg/day

One-alpha drops (1 drop=0.1 mcg)

If symptoms improve: Continue oral Ca & Vit D (1,25-dihydroxyvitamin D) supplementation

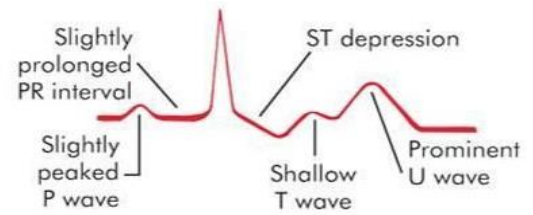
If symptoms did not improve: Increase oral Ca by 1-2g daily in divided doses, re-measure serum Mg and repeat MgSO4 if low

- If still no improvement, switch to IV Ca and evaluate malabsorption (ex. in celiac)



Definitions:

- Mild hypokalemia – Potassium level between 3 and 3.5 mEq/L
- Moderate hypokalemia – Potassium level between 2.5 and 3 mEq/L
- Severe hypokalemia – Potassium level less than 2.5 mEq/L



Signs and Symptoms:

1. Generalized muscle weakness
2. Paralytic ileus
3. Cardiac arrhythmias: atrial tachycardia, AV dissociation
4. EKG Changes: Flat/inverted T waves, ST segment depression, U waves
5. Ascending paralysis and impaired respiratory function ($K < 2$)

Age	K ⁺ Normal Range
Premature infant	4 to 6.5
Newborn	3.7 to 5.9
Infant	4.1 to 5.3
Child >1 year old	3.5 to 5

Causes

1. **GI:** diarrhea, vomiting, nasogastric drainage, anorexia, bulimia.
2. **Increased intercellular uptake:** alkalosis, insulin, Beta adrenergic agents, periodic paralysis (genetic etiology, hyperthyroidism), Drugs (Barium, antipsychotics, chloroquine).
3. **Increased Urinary loss:** Diuretics, Renal tubular Acidosis, Hyperaldosteronism.
4. **Increased skin loss:** Cystic Fibrosis.

Management

1. Treat patients who are **symptomatic** or who have **severe hypokalemia**
2. Treat underlying or contributing cause (e.g. hypomagnesemia).
3. Patients should be kept on ECG monitoring
4. Correction dose 0.3-0.5 mEq/kg over 1 hour (patient should be on cardiac monitor)
5. Potassium concentration of no more than 40 mEq/L is given intravenously (**Maximum K⁺ that can be given in a peripheral line is 20 mEq/pint**)

Definition: Serum Na level > 150 mmol/L

APPROACH

- Hypervolemia = excessive salt ingestion, Conn's syndrome, Cushing's syndrome
- Euvolemia = Diabetes Insipidus, hypodipsia
- Hypovolemia = vomiting & diarrhea, insensible losses (respiratory & dermal), diuretics (loop), mannitol

MANAGEMENT

Choice of replacement fluid: $\frac{1}{2}$ NS + D5% (or 0.9% NS + D5%)

- Standard calculation:
 - Free water deficit = $4 \times \text{WT} \times (\text{actual Na} - \text{desired Na}) = \dots \text{ mL of free water}$
 - 400 mL of free water = 1000 mL of $\frac{1}{2}$ NS + D5%
 - Final correction = free water deficit + [2 x maintenance] – bolus / 48 = $\dots \text{ mL/hr}$
 - Monitor Na level Q2-4hr; should not fall by $>0.5 \text{ mmol/L/hr}$
 - Adjust IVF based on Na level; if child develops seizures, 3% NaCl (2-5 mL/kg over 15-20 mins) is indicated

*Difference between actual Na and desired Na **should not exceed 10 mmol**

- Fast calculation:
 - Start IVF at a rate of $1.5 \times \text{maintenance} = \dots \text{ mL/hr}$
 - **Monitor Na level Q2-4hr; should not fall by $>0.5 \text{ mmol/L/hr}$**
 - Adjust IVF based on Na level; if child develops seizures, 3% NaCl (2-5 mL/kg over 15-20 mins) is indicated

Example:

A 10 kg child presented with dehydration and was found to have Na level 160 mmol/L

1. Free water deficit = $4 \times 10 \times (160 - 150) = 400 \text{ mL of free water}$
2. So, if 400 mL free water = 1000 mL of $\frac{1}{2}$ NS + D5%
3. Final correction = $1000 + (2 \times 1000) - 0 / 48 = 62.5 \text{ mL/hr of } \frac{1}{2}\text{NS} + \text{D5\%}$

OR

1. Start IVF $\frac{1}{2}$ NS + D5% at rate of 61.5 mL/hr

COMPLICATIONS

- **Complication of hypernatremia:** Cerebral hemorrhage
- **Complication of therapy:** Cerebral edema

Definition: Serum Na level < 130 mmol/L

APPROACH

- Normal osmolality = hyperproteinemia, hyperlipidemia
- High osmolality = hyperglycemia (diabetic ketoacidosis), mannitol
- Low osmolality =
 - Hypovolemia = vomiting & diarrhea, diuretics (thiazide), CAH, Addison's disease, cerebral salt-wasting syndrome
 - Euvolemia = SIADH, psychogenic polydipsia, water intoxication, hypothyroidism
 - Hypervolemia = congestive heart failure, cirrhosis, renal failure, nephrotic syndrome

MANAGEMENT

Choice of replacement fluid: 0.9% NaCl + D5%

- Standard calculation:
 - Sodium deficit = $0.6 \times \text{WT} \times (\text{desired Na} - \text{actual Na})^* = \dots \text{ mmol of Na}$
 - 154 mmol of Na = 1000 mL of NS
 - Final correction = $\text{sodium deficit} + \text{maintenance} - \text{bolus} / 24 = \dots \text{ mL/hr}$
 - Monitor Na level Q2-4hr; should not raise by $>0.5 \text{ mmol/L/hr}$

*Difference between desired Na and actual Na **should not exceed 10 mmol**

- Fast calculation:
 - Start on IVF rate of $1.5 \times \text{maintenance} = \dots \text{ mL/hr}$
 - Monitor Na level Q2-4hr; should not raise by $>0.5 \text{ mmol/L/hr}$

Example:

A 10 kg child presented with dehydration and was found to have a Na level 115 mmol/L

1. Sodium deficit = $0.6 \times 10 \times (125 - 115) = 60 \text{ mmol of Na}$
2. So, if 154 mmol of Na = 1000 mL of NS
3. Final correction = $389.6 + 1000 - 0 / 24 = 57.9 \text{ mL/hr of NS}$

OR

1. Start IVF NS at rate of 61.5 mL/hr

COMPLICATIONS

- **Complication of hypernatremia:** Cerebral edema
- **Complication of therapy:** Osmotic demyelination syndrome

Step 1: acute correction – until seizures stop

- 2-5 mL/kg of 3% NaCl over 15-20 mins (can repeat until seizures stop)
- Once seizures are aborted, recheck Na level and go to step 2

Step 2: slow correction – use NS alone

- Sodium deficit = $0.6 \times \text{WT} \times (\text{desired Na} - \text{actual Na}) = \dots$ mmol of Na
 - 154 mmol of Na = 1000 mL of NS
- Final correction = sodium deficit + maintenance – bolus / 24 = ... mL/hr
- Monitor Na level Q2-4hr; should not raise by >0.5 mmol/L/hr

*Difference between desired Na and actual Na **should not exceed 8 mmol**

Example

A 10 kg dehydrated child presented with seizures and was found to have a Na level 115 mmol/L

1. Start 20 mL of 3% NaCl over 15-20 mins

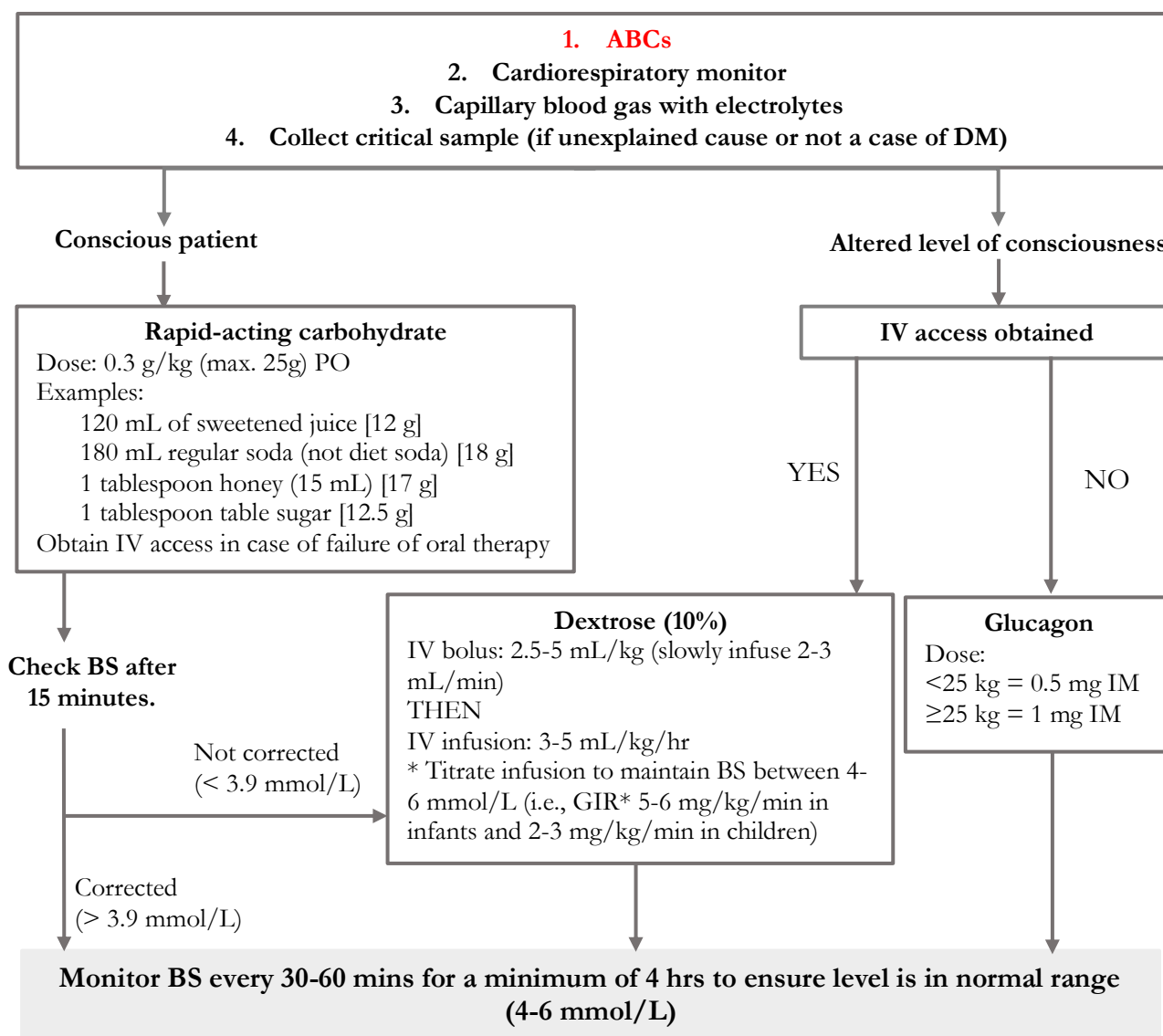
As an example, the seizures have now aborted and a repeated Na level is 125 mmol/L

1. Sodium deficit = $0.6 \times 10 \times (133 - 125) = 48$ mmol of Na
2. So, if 154 mmol of Na = 1000 mL of NS
3. Final correction = $311.6 + 1000 - 0 / 24 = 54.6$ mL/hr of NS

Definitions	
>3y	<2.8 mmol/L
1m to 3y	<3.3 mmol/L
Diabetic children	<3.9 mmol/L

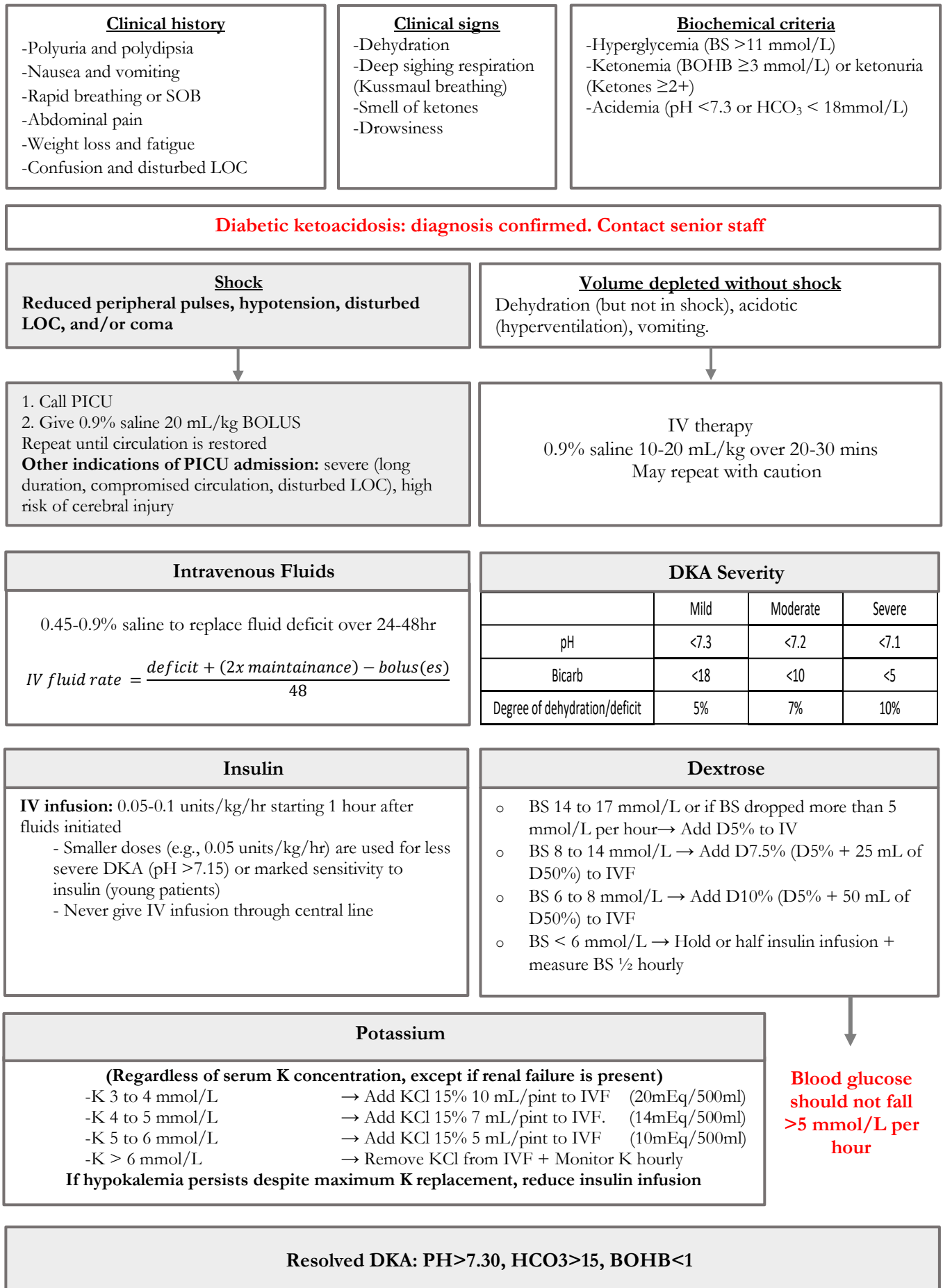
Signs and symptoms of Hypoglycemia
<u>Children:</u> excessive sweating, palpitations, tremor, peri-oral tingling, anxiety, lethargy, tiredness, changes in behavior, headache, visual disturbances, slurred speech, dizziness, altered LOC, coma or convulsions.
<u>Infants:</u> irritability, jitteriness, poor feeding, hypotonia, tachypnea, apnea, cyanosis or abnormal movements

Critical Sample			
Test	tube	Amount	precautions
1-Glucose/lactate	Gray	1ml	Put in ice
2-Insulin	Red	5ml	-
3-GH			
4-Cortisol			
5-Ketones(β -hydroxybutarate)			
6-Free fatty acid			
7-C-peptide			
8-Ammonia	EDTA	1ml	Put in ice
9-Plasma amino acid	purple	3ml	-
10-Acyl-carnitine profile	Filter paper	-	-
DO NOT delay management to collect critical sample			



$$\text{GIR} = \text{glucose infusion rate} = (\text{dextrose percentage} \times 10 \times \text{rate of infusion [mL/hr]}) \div (60 \times \text{Wt [kg]})$$

Diabetic Ketoacidosis



Monitor

Hourly: vital signs, neurological assessment, I/O chart, BS, amount of administered insulin
2-4hourly: electrolytes (including Ca, Mg, Phos), BUN, blood gasses, blood ketones

Corrected Na

$$\text{corrected Na} = \text{Na} + \left(\frac{2 \times (\text{BG} - 5.5)}{5.5} \right)$$

For each 10mmol rise in BS, there is 3 mmol drop of Na

Persistent Acidosis

- Reassess the patient
- Review insulin therapy (calculation, preparation, insulin set), Review IVF calculation.
- Consider other possibilities
 - o Sepsis
 - o Hyperchloremia
 - Check BHOB to confirm resolved DKA
 - Usually, asymptomatic
 - Rx: use K₂PO₄ instead of KCl

Things to Avoid

- Use of bicarbonate except:
 - o Life threatening hyperkalemia
 - o Severe acidosis (pH <6.9)
 - o Compromised cardiac contractility
- Use of central venous catheter (risk of thrombosis):
 - o If inserted, consider mechanical or pharmacological prophylaxis (LMWH) esp. if > 12yrs
 - o Insulin should NOT be given through central line

If patient is obese; no need to use ideal weight (if exceeds adult calculation, use adult protocol. 1 L maximum for the bolus and 500 mL/hr infusion). To avoid excessive amounts of fluid in overweight and obese children it is recommended that consideration be given to using a maximum weight of 80kg or 97th centile weight for age (whichever is lower) when calculating both deficit and maintenance requirements.

Cerebral Edema in DKA

Risk Factors for Cerebral Edema

- Younger age (<5 years)
- New onset diabetes
- Longer duration of symptoms
- Profound hypocapnia at presentation
- Increased BUN at presentation
- More severe acidosis at presentation
- Bicarbonate treatment

Diagnosis of Cerebral Edema

- 1 diagnostic criterion, or
- 2 major criteria, or
- 1 major and 2 minor criteria, or
- 1 major and 1 minor criterion (if child under 5 years of age)

Diagnostic criteria	Major criteria	Minor criteria
<ul style="list-style-type: none"> - Abnormal motor or verbal response to pain - Decorticate or decerebrate posture - CN palsy (III, IV, VI) - Abnormal neurogenic respiratory pattern (grunting, tachypnea, Cheyne-stoke respiration, apneusis) 	<ul style="list-style-type: none"> - Altered mentation, confusion, fluctuating LOC - Sustained HR deceleration (>20bpm) not attributable to improved IV volume or sleep status - Age-inappropriate incontinence 	<ul style="list-style-type: none"> - Vomiting - Headache - Lethargy or not easily arousable - Diastolic BP > 90 mmhg - Age <5yr

Management of Cerebral Edema

- Initiate treatment as soon as the condition is suspected
- DO NOT rely on neuroimaging to make or exclude the diagnosis
- Adjust fluid rate
- Mannitol
 - Dose: 0.5–1 g/kg IV over 10–15 mins
 - Onset of effect: after 15 mins
 - Duration of effect: 120 mins
 - Can be repeated after 30 mins
- 3% hypertonic saline
 - Alternative to or in addition to mannitol, if there is no response to mannitol.
 - Dose: 2.5–5 mL/kg IV over 10–15 mins
- Cranial imaging after stabilizing patient (DO NOT delay management to obtain imaging). Primary concern that warrants imaging is whether the patient has a lesion that requires intervention (hemorrhage, thrombosis)
- Involve PICU as soon as possible
- Note: rule out hypoglycemia as symptoms may mimic those of cerebral edema

Acute onset + one of the following criteria

Criteria I Muco-cutaneous manifestations + 1 of the following systems involvement (if unknown allergen): <ul style="list-style-type: none"> - Respiratory symptoms - ↓ BP or end-organ dysfunction (hypotonia syncope, incontinence) 	Criteria II Exposure to likely allergen to that patient + 2 or more of the following systems involvement: <ul style="list-style-type: none"> - Mucocutaneous - Respiratory - CVS (↓ BP) - GIT system 	Criteria III Exposure to known allergen to that patient + ↓ BP
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ABCs first!

Airway: Maintain airway, immediate intubation if evidence of impending airway obstruction

Epinephrine IM (1:1000): 0.01 ml/kg (equivalent to 0.01 mg/kg) (max. 0.5ml) In mid – anterolateral thigh Repeat every 5 – 15 min as needed

Quick emergency doses of epi:
 <6 yrs → 0.15 ml
 6-12 yrs → 0.3 ml
 >12yrs → 0.5 ml

Administer 100% O₂ , 2 large-bore IV cannulas, hemodynamic monitoring (HR, BP and oxygen saturation), place in recumbent position and elevate legs if tolerated.

Breathing

Bronchospasm: nebulized albuterol 0.15 mg/kg (minimum 2.5 mg) + 3ml NS (repeat as needed).
 Stridor: continuous nebulization of epinephrine 0.5 ml/kg (max 5 ml)

Circulation

Circulation: if signs of poor perfusion: bolus of 0.9% NS 20 ml/kg (over 5-10 minutes) and repeat as needed. Monitor urine output.

Consider:

- Diphenhydramine IV (H1 antihistamine) 1 mg/kg/dose (max 50 mg)
- Methylprednisolone IV 1-2 mg/kg (max 125mg)
- PO cetirizine: 6 mo-<2 yrs: 2.5 mg OD ; 2–5 yrs: 2.5–5 mg OD ; >5 yrs: 5–10 mg OD
- Cases refractory to IM epinephrine:
 - o Consider glucagon IV 20-30 mcg/kg over 5 min (max cumulative dose of 1 mg) followed by infusion 5-15 mcg/min (treat to clinical effect)
 - o Consider IV epinephrine infusion for hypotension 0.05 - 1.5 mcg/kg/min (max dose 10 mcg/minute)

CALL PICU (for vasoactive medications or signs of upper airway obstruction)

RECTAL TEMPERATURE $\geq 38^{\circ}\text{C}$

Admit to the hospital & obtain full septic workup

NO Respiratory or Circulatory Compromise* YES

HISTORY AND EXAMINATION

History:

- Poor feeding, lethargy, increased crying, weak cry, difficulty breathing
- Maternal risk factors: Maternal fever, GBS colonization or administration of antibiotics at time of delivery, chorioamnionitis. HSV infection, STI.

Physical Examination:

- Focal bacterial infection
- Otitis media, cellulitis, abscess, mastitis, pneumonia, osteomyelitis, bacterial arthritis, omphalitis.
- Serious viral infection
- HSV (vesicles, seizures, focal neurological deficit, respiratory distress)
- Bronchiolitis (tachypnea, nasal discharge, cough, rales, wheezing)
- Rule out other causes of ill appearance: congenital heart disease, congenital adrenal hyperplasia, inborn errors of metabolism, malrotation with volvulus.

Full evaluation for All ill-appearing patients:

Full septic workup:

- CBC and differential
- Inflammatory markers (PCT, CRP)
- Blood C/S
- Urine C/S, urinalysis
- COVID-19 PCR
- Chest X-ray
- Stool culture: if diarrhea or stool containing blood or mucus
- CSF: cell count and differential, glucose, protein, bacterial culture, gram stain, PCR for HSV + Enterovirus.

Signs of Septic shock:

- PT, APTT, INR
- Fibrinogen and D-Dimer
- Serum lactate
- Serum total bilirubin and ALT
- Ionized calcium

Findings of Bronchiolitis

- Add rapid RSV test

Findings of Influenza

- Add Influenza PCR

Findings of HSV infection:

- Swab from vesicles for PCR
- Blood PCR for HSV
- Serum AST and ALT

Empirical antibiotic therapy (**WITH** Focus)

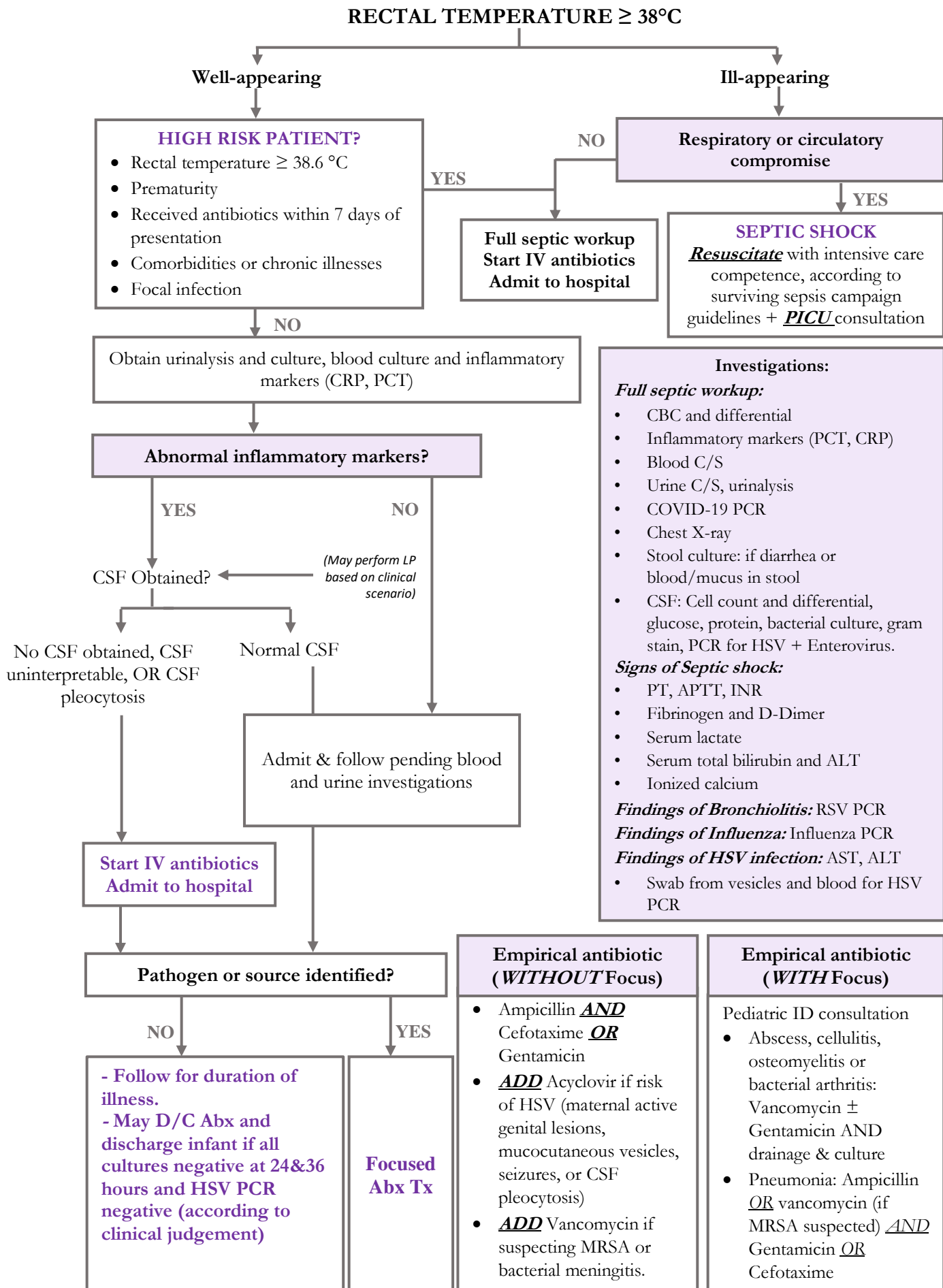
- Pediatric infectious disease consultation
- Abscess, cellulitis, osteomyelitis or bacterial arthritis:
 - Vancomycin **AND** gentamicin **OR** Vancomycin alone
 - Drainage and culture of any abscess, surgical source control
- Pneumonia:
 - < 7 days old: Ampicillin **AND** gentamicin
 - > 7 days: Ampicillin **OR** vancomycin (if MRSA suspected) **AND** Gentamicin **OR** cefotaxime

Empirical antibiotic therapy (**WITHOUT** Focus)

- Ampicillin **AND** cefotaxime **OR** gentamicin
- **ADD** Acyclovir if patient is at risk due to exposure (maternal active genital lesions, mucocutaneous vesicles, seizures, of CSF pleocytosis)
- **ADD** Vancomycin if in region with high prevalence of MRSA (>10% of isolates), or if findings of bacterial meningitis are present

DISCHARGE CRITERIA

Neonates should receive inpatient care and parenteral antibiotics until all cultures are negative for at least 48 hours. Acyclovir should be continued until results of all HSV testing are negative

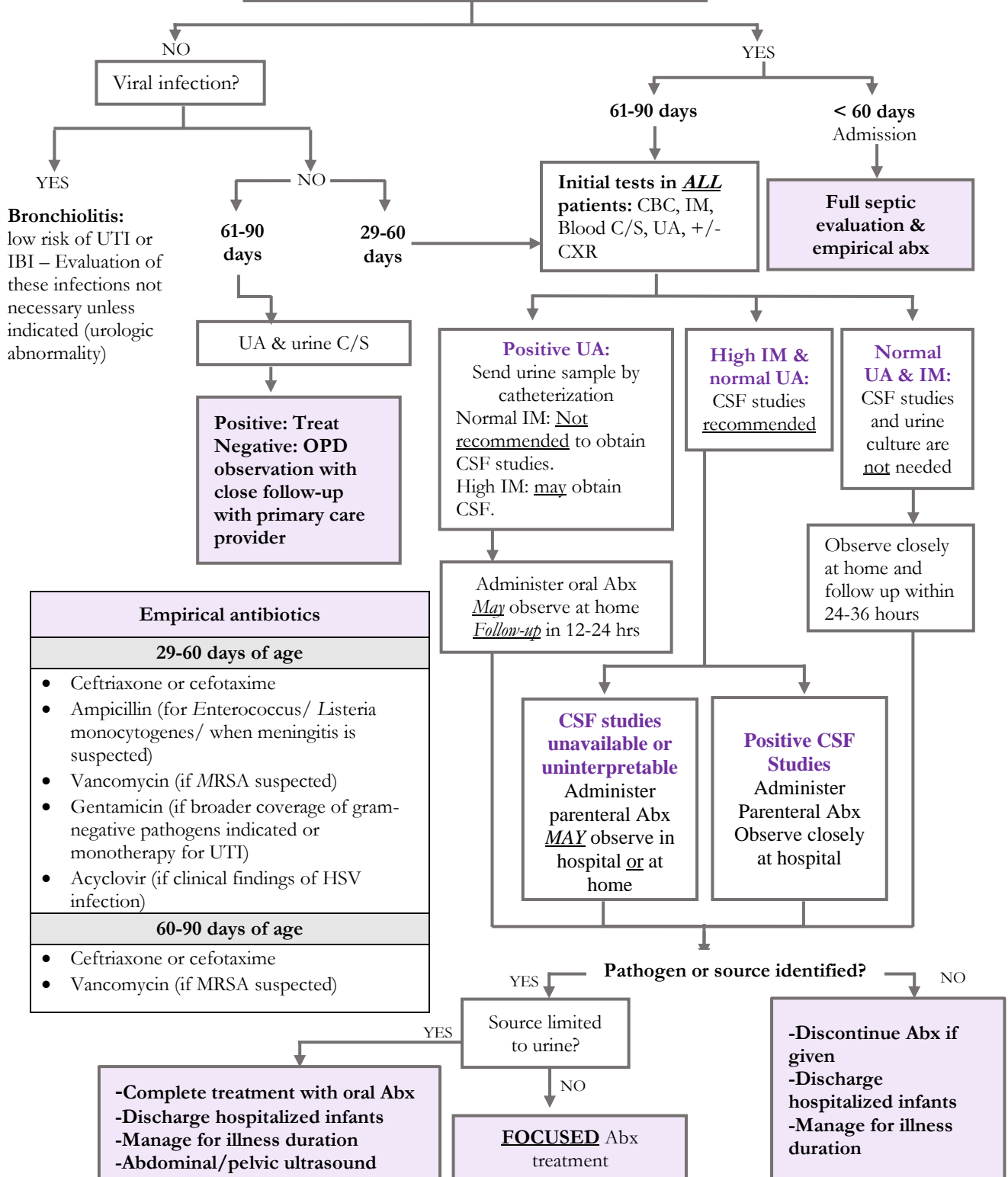


Well Febrile Infant (29-90 Days)

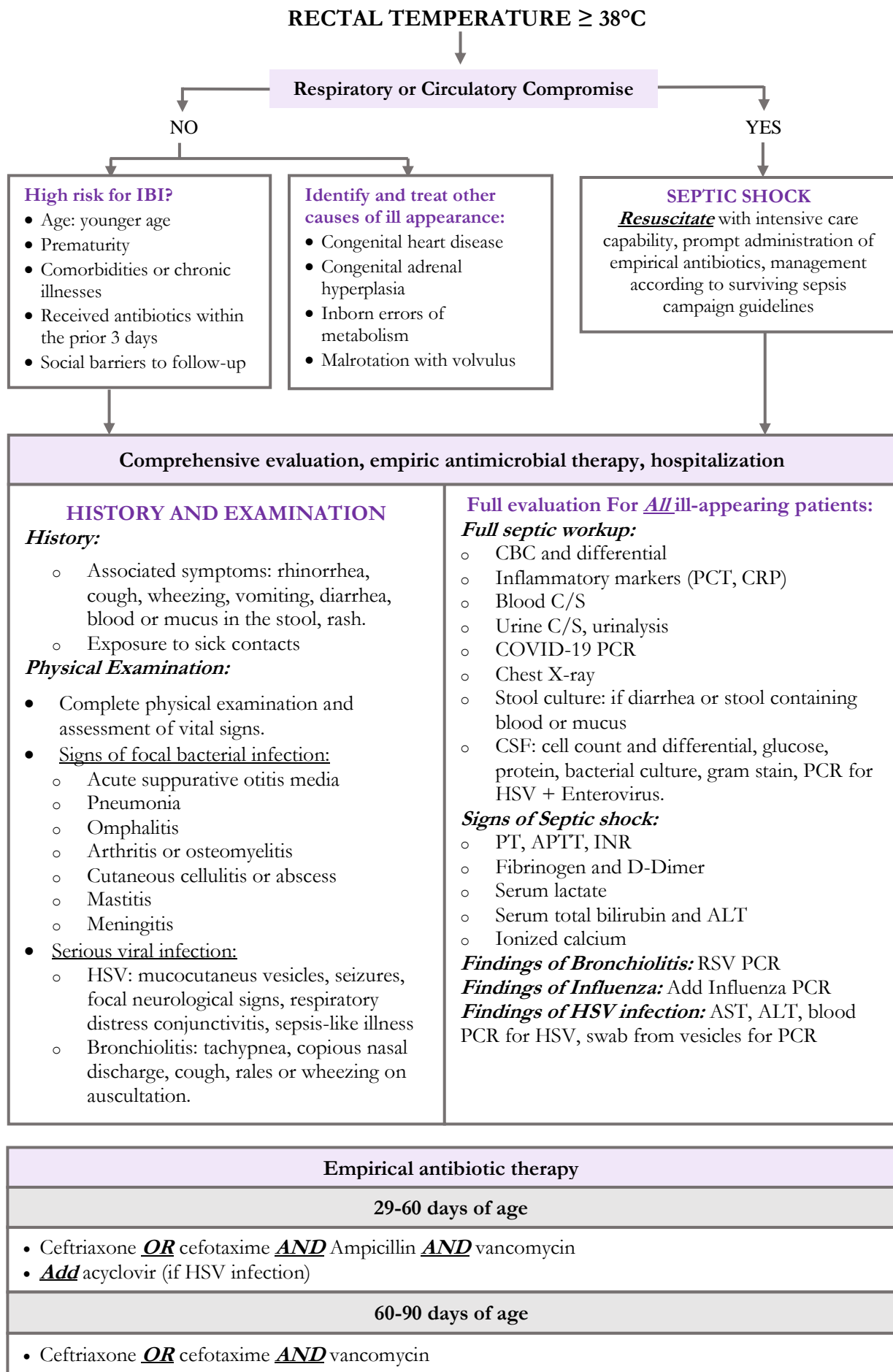
RECTAL TEMPERATURE $\geq 38^{\circ}\text{C}$

HIGH RISK PATIENT FOR INVASIVE BACTERIAL INFECTION?

- Rectal temperature $\geq 38.6^{\circ}\text{C}$
- Prematurity
- Received antibiotics within 7 days of presentation
- Comorbidities or chronic illnesses
- Focal infection

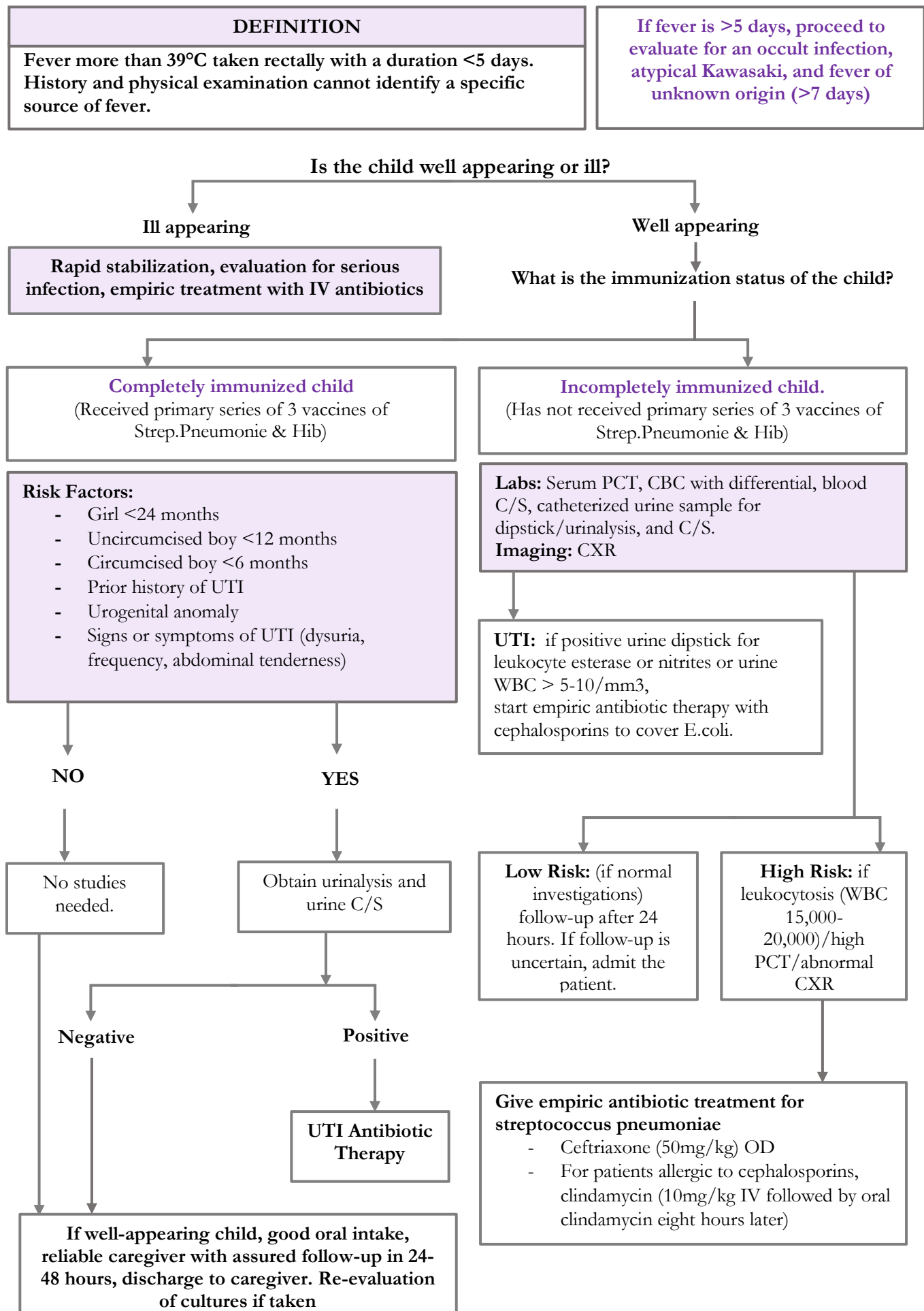


Ill Febrile Infant (29-90 Days)



If the patient is in septic shock, follow *septic shock* algorithm

Fever Without Focus (3-36 Months)



Non-chemotherapy Induced Febrile Neutropenia

Definition of Febrile Neutropenia: Fever in neutropenic patient defined as a single oral T $\geq 38.3^{\circ}\text{C}$, a T $\geq 38^{\circ}\text{C}$ for longer than 1hr, or 2 elevations $\geq 38^{\circ}\text{C}$ during a 12hr period.

Neutropenia: defined as ANC <1500 cells/microL.

Mild: ANC 1000 – 1500/microL, **Moderate:** ANC 500 – 1000/microL, **Severe:** ANC

Low Risk Patient

Healthy child with isolated transient neutropenia (i.e. viral infection/meds)

Management

- Follow up with repeated CBC, until neutropenia improves. (after 1-2wks)
- PO antibiotics for localized bacterial infection. (e.g. AOM, skin infection)

Low-Moderate risk

Well appearing child with chronic benign neutropenia, chronic idiopathic neutropenia or cyclic neutropenia.

High Risk patients

- Ill appearing children w/ neutropenia whether they are febrile or not. (hypothermic, hypotensive, listless, confused)
- Well or ill appearing children w/ severe congenital neutropenia and fever (Kostmann syndrome)
- Well or ill appearing children with acquired or inherited aplastic anemia and fever
- Well or ill appearing children with other bone marrow failure syndromes (cartilage-hair hypoplasia, reticular dysgenesis)

In chronic benign neutropenia:

- For common infections: URTI, AOM, and gingivitis \rightarrow PO antibiotics + close outpatient F/U. If skin & soft tissue infections \rightarrow consider admission + IV antibiotics
- Less common e.g. pneumonia, periorbital cellulitis, labial cellulitis or abscess, meningitis, sepsis \rightarrow admit + IV antibiotics for complicated febrile illness. Individualized Rx for children with H/O complicated febrile illness.

In cyclic neutropenia:

- For common infections e.g. oral ulcers, gingivitis, periodontitis, pharyngitis, adenopathy \rightarrow supportive care (no antibiotics needed)
- Less common e.g. bacteremia, cellulitis, AOM, sinusitis, pneumonia, and peritonitis \rightarrow individualized management if atypical fever, H/O complicated febrile illness, or localized infection.
- Uncommon *C.difficile* associated NEC \rightarrow admit & IV antibiotics.

Severe congenital neutropenia (Kostmann syndrome): omphalitis, cellulitis, perirectal abscess, sepsis \rightarrow admit + broad spectrum Abx

Aplastic anemia, including inherited form (Schwachman-Diamond syndrome, Fanconi anemia, Dyskeratosis congenital): dyskeratosis congenita, soft tissue infection, bacteremia, invasive fungal disease esp. due to *Aspergillus* spp. \rightarrow admit + broad spectrum Abx. Antifungal agents for persistent unexplained fever.

Ill appearing child with neutropenia: cellulitis, perirectal abscess, sepsis, respiratory infections, bacteremia, invasive fungal disease esp. due to *Aspergillus* spp. \rightarrow admit + broad spectrum Abx. Antifungal agents may be warranted for persistent unexplained fever.

Complicated febrile illness is defined by one or more of the following:

- Hemodynamically unstable
- GI symptoms
- New onset neurological signs or mental status changes
- IV catheter infection
- Underlying chronic lung disease
- New lung infiltrate or low O₂
- Skin or soft tissue infection
- Sinus tenderness or other URTIs.

Antimicrobial therapy for moderate / high risk neutropenia:

1. Uncomplicated febrile illness → monotherapy of Cefepime, Meropenem, or Piperacillin-Tazobactam.
2. Signs of sepsis and unstable patient → ID & pediatric critical care consultations.
 - For children w/ no H/O multidrug resistant organisms → Piperacillin-Tazobactam
 - For children w/ H/O multidrug resistant organisms → Meropenem or Ceftazidime-avibactam, or Ceftolozane-Tazobactam.
 - For children w/ H/O or concern for Meropenem-resistant *Enterobacterales* → broad spectrum antipseudomonal therapy **PLUS** colistin.
3. Hemodynamically stable with GI symptoms (abdominal pain or blood per rectum) → Meropenem or Tazocin or combination of Cefepime **AND** Metronidazole. Suspected *C. difficile* → combination therapy of antipseudomonal agent same as above **PLUS** therapy for *C. difficile*.
4. If the patient is clinically stable and has no signs of infection after 48-72hrs of antimicrobial therapy and no fever → discontinue therapy and monitor clinically.
5. If clinically stable & no signs of infection at 72hrs of antibiotics but remain febrile → continue antibiotic & re-evaluate.
6. If the patient remained febrile & severely neutropenic & no count recovery after 4-5days of antibiotics → investigate fungal infection.

Pediatric Antibiotic Guidelines

SEPSIS & MENINGITIS	
< 28 days with sepsis	Ampicillin (200 mg/kg/day 6-8 hourly) + Cefotaxime (200 mg/kg/day 6-8hrly)
< 28 days with meningitis	Ampicillin (300 mg/kg/day 6-8 hourly) + Cefotaxime (200 mg/kg/day 6-8hrly)
>28 days with sepsis	Cefotaxime (200 mg/kg/day 6-8hrly) OR Ceftriaxone (100 mg/kg/day 12-24 hourly) +/- Vancomycin (45-60mg/kg/day
>28 days with meningitis	Ceftriaxone (100 mg/kg/day 12-24 hourly) + Vancomycin (60mg/kg/day 6hrly)

UPPER & LOWER RESPIRATORY TRACT INFECTIONS	
Acute otitis media	Watchful waiting for >2yrs of age with unilateral AOM without severe symptoms, otherwise may use Amoxicillin (90 mg/kg/day BD PO)
Acute follicular tonsillitis	Amoxicillin 50 mg/kg/day BD PO for 10 days
Acute bacterial rhinosinusitis	-Mild/mod cases: Amoxicillin 50mg/kg/day BD PO - 10 days -severe cases: amoxicillin/clavulanate 90mg/kg/day BD PO - 10 days
Pertussis infection	-Infants < 1month: Azithromycin 10 mg/kg/dose OD PO/IV for 5 days -Infants > 1 month of age and children: Azithromycin 10 mg/kg/dose OD PO/IV for 5 days OR clarithromycin
Community acquired pneumonia 1-3 months of age	-IV cefotaxime 150-200mg/kg/day 6-8hrly -If afebrile and C. trachomatis is suspected: start Azithromycin
Community acquired pneumonia 3 months – 5 years	-If appropriately immunized: Amoxicillin 90mg/kg/day BD PO * Amoxicillin/Clavulanate 90mg/kg/day BD PO for severe cases * Ampicillin 150-200 mg/kg/day IV 6 hrly * Cefotaxime 150-200 mg/kg/day IV 6-8hrly – for severe cases/failure or 1 st line therapy * Ceftriaxone 50-100 mg/kg/day IV 12-24 hrly – for severe cases/failure of 1 st line therapy
Community acquired pneumonia > 5 years	If atypical pneumonia is suspected add Azithromycin PO 10mg/kg/day on day 1 followed by 5mg/kg/daily for 4 more days OR Clarithromycin 15 mg/kg/day BD PO
Complicated community acquired pneumonia (effusion/empyema)	IV Ceftriaxone 50-100 mg/kg/day 12-24 hrly OR IV Cefotaxime 150-200 mg/kg/day 6-8hrly If MRSA or anaerobic infection suspected PLUS IV Clindamycin 300 mg/kg/day 8 hrly OR IV Vancomycin 60 mg/kg/day 6 hrly
Aspiration pneumonia	Cefotaxime 150 to 200 mg/kg/day 6-8hrly IV +/- Clindamycin 30-40 mg/kg/day 8 hrly IV -Vancomycin – if MRSA is suspected

SKIN & SOFT TISSUE INFECTIONS

Pre-septal cellulitis	-Amoxicillin Clavulanic acid 90 mg/kg/day BD PO If there is H/O trauma Trimethoprim-Sulfamethoxazole 10mg/kg/day BD PO PLUS -Amoxicillin-Clavulanic acid 90 mg/kg/day BD PO OR -Cefuroxime 30mg/kg/day BD PO
Orbital cellulitis	IV Vancomycin 40-60mg/kg/day 6hrly PLUS -IV Ceftriaxone 50mg/kg/dose OD OR -IV Cefotaxime 150-200mg/kg/day 8hrly
Cat bite cellulitis	-Amoxicillin-Clavulanic acid 90 mg/kg/day BD PO
Cellulitis	-Oral Cephalexin 25-100mg/kg/day divided 6hrly (max 2g/day) *High dose recommended if MSSA or more severe infection is suspected -Oral Clindamycin 25-40mg/kg/day 8hrly

SEPTIC ARTHRITIS & OSTEOMYELITIS

Infants < 3 months of age	IV Cefazolin 100-150mg/kg/day 8hrly (max 6g/day) PLUS IV Cefotaxime 150-200mg/kg/day 6-8hrly (max 12g/day)
Infants >3 months of age and children	IV Cefazolin 100-150mg/kg/day 8 hrly (max 6g/day) OR IV Clindamycin 10mg/kg/dose 6-8hrly OR IV Cloxacillin 200mg/kg/day divided 4 hrly (max dose 4g/day)

Child with sickle cell disease + fever $\geq 38.5^{\circ}\text{C}$

Triage waiting time should be <4 hours from the onset of fever	
History + focused examination <ul style="list-style-type: none"> o Hemodynamic stability, vital signs, cardiopulmonary status o Immunization status o Degree of pallor, spleen size o Signs of infection (localized or generalized) o Evidence of stroke 	Investigations <ul style="list-style-type: none"> CBC+Retic Type & Screen: (not sickle cell on request) RFT & LFT Blood culture/indwelling catheter culture (if present) Other cultures as indicated CXR: if respiratory symptoms
Management	
<p>Consider IV fluid bolus</p> <p>Empiric parenteral antibiotics (should not be delayed, administer within 1 hour of presentation)</p> <p>Ceftriaxone IV 50-75 mg/kg (Max single dose 2 gm)</p> <p>If suspected meningitis or hemodynamically unstable: ADD Vancomycin IV 15-20 mg/kg q6hr (Max single dose 1 gm)</p>	
Evaluate associated conditions	
<p>Splenic sequestration: Acute spleen enlargement, tender spleen, thrombocytopenia, \uparrowretics</p> <p>Acute chest syndrome: chest pain, hypoxemia, respiratory distress</p> <p>Aplastic crisis (parvovirus B19): Severe pallor, \downarrow retics, tachycardia</p>	
Criteria for admission	Criteria for outpatient management
Clinical criteria: <ul style="list-style-type: none"> - ≤ 6m of age with HbSS or HbS-β thal - Signs of systemic toxicity, hemodynamic instability - H/O Bacteremia or sepsis - $T > 40^{\circ}\text{C}$ - Indwelling central venous line - Any of: ACS, painful crisis, splenic sequestration, aplastic crisis, severe dehydration - Penicillin/cephalosporin allergy - Not tolerating oral intake Lab criteria: <ul style="list-style-type: none"> - $\text{WBC} \geq 30,000$ or $\leq 5000/\text{microL}$ - Hb level $\leq 5\text{g/dl}$ or a fall $\geq 2\text{g/L}$ below baseline - Platelet count $< 100,000/\text{microL}$ or below baseline 	<ul style="list-style-type: none"> - Patient does not meet any of the admission criteria. - Patient can return for follow up in 24hrs for assessment - Physician must make sure to follow up blood culture results taken on presentation
Inpatient management	Outpatient management
<ul style="list-style-type: none"> o Monitor HR, RR, BP, O2 Sat q4-6hr o Adequate hydration with fluids at maintenance rate. Replace deficits / ongoing losses if present o Continue antibiotic coverage o If culture: <ul style="list-style-type: none"> ▪ Negative: D/C Abx if cultures are negative at 48hrs. ▪ Positive: Continue Abx + readjust depending on sensitivity <u>x 7-10 days</u> 	<ul style="list-style-type: none"> - On F/U, assess clinical status. If any new clinical signs (mentioned above) are present, consider admission. - Antibiotic therapy; either Another dose of IV ceftriaxone. OR PO cefixime (or equivalent) at 8 mg/kg/day x2 doses (Max: 400 mg/day) - Cover patient with Abx until blood cultures at 48hrs are negative. - If blood cultures are positive, call patient for admission.

Brief history and physical examination, considering manifestations of SCD complications.

Evaluate the pain using FPS-R scale



Mild (0-2) moderate (3-6) severe (7-10)

Initial Management

- IVF bolus of 10 ml/kg NS over 1hr then 1.5x maintenance D5%NS.
- Oxygenation 3-4 L if SPO2 < 95% on room air.
- Initiate analgesia within 30-60 minutes depending on the severity.

Mild Pain

- IV acetaminophen (10-15 mg/kg) q4h – q6h
- NSAIDs: Ibuprofen (10 mg/kg) q6h – q8h (oral or IV, but not both)

If the pain is persistent, consider the moderate/severe pain category.

Moderate/Severe Pain

- PO Morphine (0.2-0.5 mg/kg/dose) q4h – q6h (max. 15mg/dose).
- IV Morphine (0.05-0.1 mg/kg/dose) (max. 10mg).

Consultation with pediatric hematologist is recommended.

Investigations

CBC, retics, cross-matching and grouping (if needed), and CXR

Important Considerations

- 1- Avoid cold packs.
- 2- Avoid dehydration or hyperhydration.
- 3- Consider other SCD complications and differential diagnoses.
- 4- Promote incentive spirometry, especially in VOE in chest or back.
- 5- Ensure spo2 > 94%, supplemental O2 not always needed.
- 6- Ensure seated posture and walking ASAP, to decrease pulmonary complications.
- 7- If the patient is using hydroxyurea, continue using it.

Child with SCD and one or more of the following: chest pain, fever $>38.5^{\circ}\text{C}$, hypoxemia, respiratory distress (cough, wheezes, tachypnea, retractions)

CXR

- New pulmonary infiltrate(s) in at least one segment of the lungs (not atelectasis) **PLUS** one of the above symptoms = **ACS**
- If normal/baseline changes + high suspicion = repeat in 24 – 48 hours

Monitoring and Investigations

Monitor the following at least Q4h: vitals, respiratory effort, mental status, input and output + daily weight to assess fluid status.

Investigations: CBC + retics daily until clinical improvement, type and cross match, renal + liver profiles, consider BGA in severe RD, and if febrile, blood C/S \pm other cultures

Respiratory Support

- Oxygen if hypoxemic. Maintain O₂ saturation $\geq 95\%$.
- Incentive spirometry Q2-4H while awake to prevent atelectasis.
- Consider noninvasive/invasive ventilation

Fluids & Pain Control

Fluids: Isotonic fluids, replace deficit when necessary. Avoid overhydration, furosemide may be used if needed.

Pain control: non-sedating

analgesics: Ketorolac IV (3 – 5 days)
0.5mg/kg (Max 30mg) followed by
0.5mg/kg q6-8 hours (Max dose 15mg)

Opioids (Morphine) monitor for hypoventilation

Triggers and Comorbidities

- Infection: **ALL** patients should be started on: 3rd generation cephalosporins for 7-10 days **AND** a Macrolide for 5 days. (Consider clindamycin if allergic to cephalosporins and/or vancomycin for suspected MRSA)
- Asthma (Acute/chronic) → Bronchodilators (even if not currently wheezy)

Transfusion

-Simple transfusion, target Hb 100-110 g/L. Indications: SpO₂ $<92\%$ on RA, Hb >10 g/L below patient's baseline, cases needing exchange transfusion where exchange will be delayed

-Indications for exchange: progressive/persistent hypoxemia and/or RD despite adequate oxygenation, progression to multi-lobar disease, Hb >20 g/L below baseline despite simple transfusion, previous history of severe ACS or cardiopulmonary disease, altered mental status or evidence of multiorgan failure.

Full history + Head to toe examination

Signs and symptoms: (cutaneous, oral cavity, epistaxis, hematuria, menorrhagia, skeletal deformities, etc.)

Initial investigations: CBC & Coagulation profile

Normal platelet count and coagulation profile

Consider the following differentials

- 1- Vasculitis
- 2- Mild factor deficiencies
- 3- FXIII deficiency (urea clot lysis, quantitative assay)
- 4- Dysfibrinogenemia (thrombin time, specific assay)
- 5- VWD (VWD:Ag, VWD:RCO, FVIII)
- 6- Platelet function disorders (platelet aggregometry)
- 7- Fibrinolytic defects (alpha 2 antiplasmin, plasminogen activator inhibitor-1)

Abnormal coagulation profile

Low platelet count

Obtain a peripheral blood smear

Consider the following differentials:

- 1- ITP
- 2- HUS
- 3- Leukemia/lymphoma
- 4- SLE
- 5- DIC
- 6- Medications
- 7- Nutritional deficiencies (B12, Folate, Iron)

Perform a mixing study

Corrected

Not corrected

Clotting factors assays

Inhibitor assays and consult hematologist

Abnormal PT/APTT and INR

Abnormal APTT

Abnormal PT and INR

- FX deficiency
- FV deficiency
- FII deficiency
- Fibrinogen
- Combined factor def.
- Vit K deficiency
- Liver disease

- FXII deficiency
- FXI deficiency
- FIX deficiency
- FVIII deficiency
- Severe VWD

- FVII deficiency
- Early Vit K deficiency

Replacement therapy

Blood grouping and cross match

- 1- PRBC: (10-20ml/kg)
- 2- Platelets: (If platelet < 50 or platelet abnormalities are present - 8 ml/kg)
- 3- Fresh frozen plasma: (for non-specific hemostatic failure 10-15 ml/kg)
- 4- Cryoprecipitate: (to correct clotting defects induced by massive transfusion or DIC - 10-15 ml/kg)
- 5- Vit K: in active bleeding (for warfarin overdose or prolonged PT/INR)
 - Non-life threatening (2mg SQ or IV)
 - Life threatening (5 mg IV)
- 6- Protamine Sulfate (for Heparin overdose 0.25-1mg IV)

DEFINITION: Unexplained fever ≥ 5 days (typically $\geq 38.5^{\circ}\text{C}$)

+4 out of 5 clinical criteria

- 1- Bilateral nonexudative conjunctivitis (spares limbus)
- 2- Polymorphous rash +/- perianal erythema & desquamation
- 3- Mucositis (one or more): erythema/fissuring of lips, strawberry tongue, pharyngeal injection
- 4- Extremity changes (one or more): erythema of palms and soles, edema of hands and feet, desquamation from fingertips
- 5- Cervical lymphadenopathy (≥ 1.5 cm)

If not fulfilling the criteria & Kawasaki is still suspected, refer to the incomplete Kawasaki algorithm

IVIG

- Observe for anaphylaxis signs while starting IVIG
- 2g/kg (Max 70 g) infusion over 8-12 hours
- Recommended within first 7-10 days
- Add steroids for high-risk patients (<1 year, fever ≥ 10 days, MAS, KD shock syndrome)
- Consider postponing live viruses' vaccines (e.g., measles, varicella) for 11 months

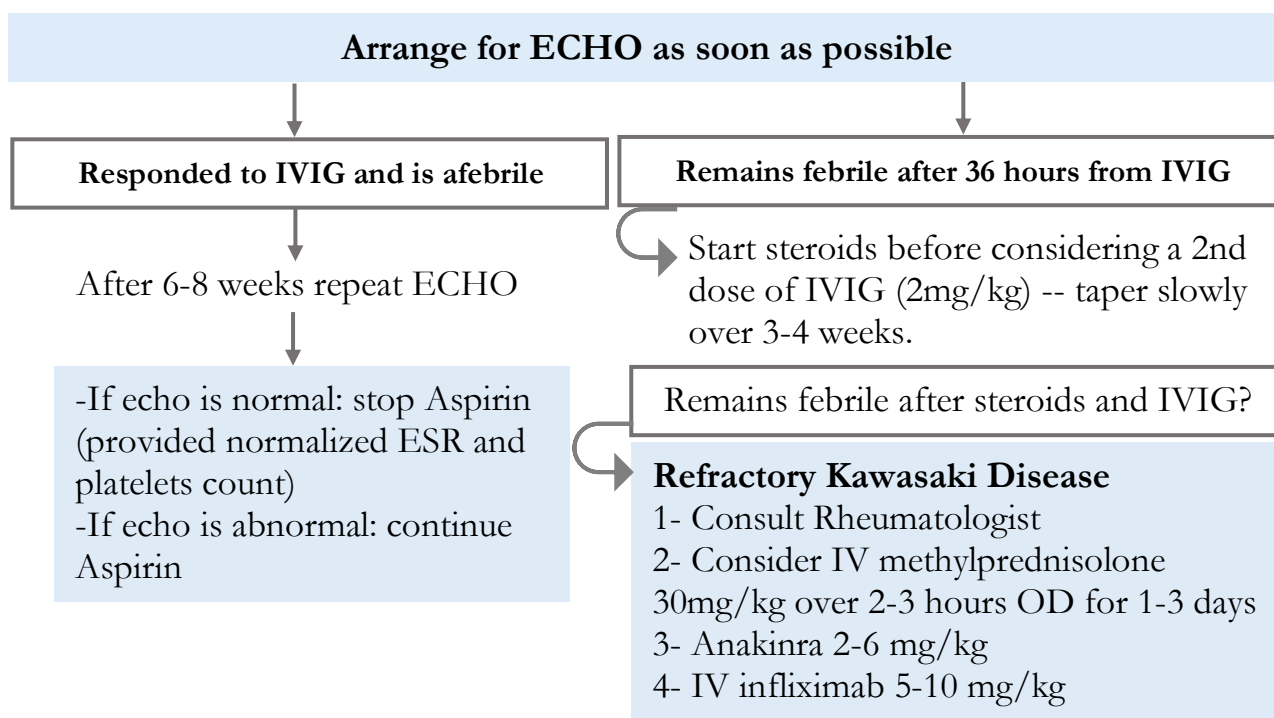
Indications of IVIG Rx if the patient presented after 10 days:

- 1- Persistent fever (without explanation)
- 2- \uparrow ESR, CRP
- 3- Positive ECHO

PLUS

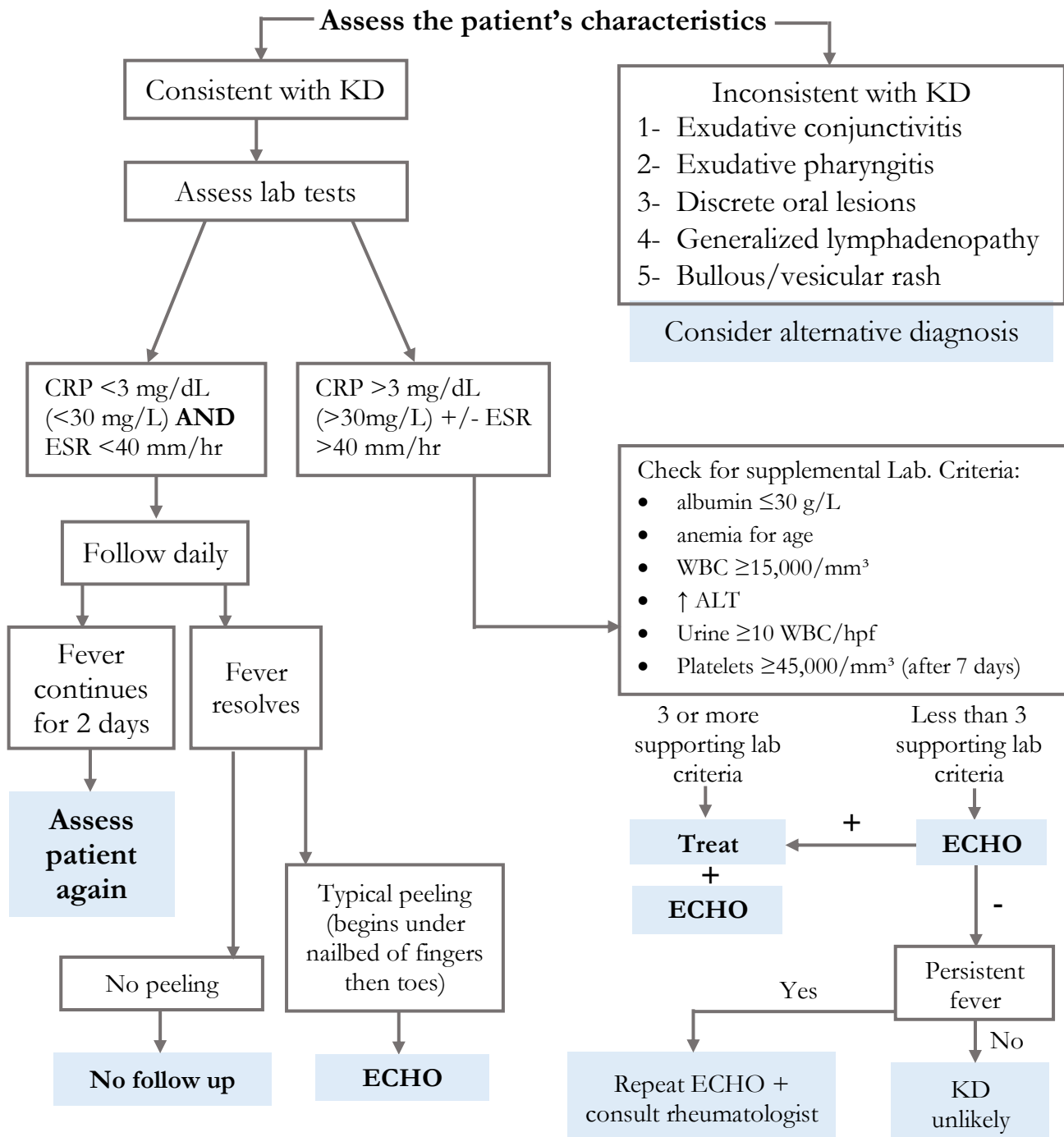
Aspirin (PO): 30-50 mg/kg day until afebrile for 48 hours then switch to low dose aspirin 3-5 mg/kg day.

* If the patient has G6PD deficiency or symptoms of influenza or varicella, or plt < 80 ; replace Aspirin with dipyridamole (PO) 4 mg/kg/day divided in 3 doses (consult cardiology)



DEFINITION: Unexplained fever ≥ 5 days (typically $\geq 38.5^{\circ}\text{C}$)
+2-3 out of 5 clinical criteria

- 1- Bilateral nonexudative conjunctivitis (sparing limbus)
- 2- Polymorphous rash +/- perianal erythema & desquamation
- 3- Mucositis (one or more): erythema/fissuring of lips, strawberry tongue, pharyngeal injection
- 4- Extremity changes (one or more): erythema of palms and soles, edema of hands and feet, desquamation from fingertips
- 5- Cervical lymphadenopathy (≥ 1.5 cm)



COPS: Pinpoint Pupils (miosis)

- Cholinergic, clonidine
- Opiates, organophosphates
- Phencyclidine, phenothiazine, pilocarpine
- Sedatives (barbiturates)

Dilated Pupils (mydriasis)

- Anticholinergics
- Antihistamines
- Sympathomimetics (amphetamine, cocaine, LSD)

Blue Skin

- Cyanosis
- Methemoglobinemia

Cherry Red Skin

- Boric acid
- Carbon monoxide

Anticholinergic Toxidrome

Dry as a bone, Red as a beet, Hot as a hare,
blind as a bat, mad like the hatter

- Dry flushed skin
- Dry mucous membranes
- Hyperthermia
- Mydriasis
- Agitation + delirium
- Urinary retention
- Tachycardia + HTN
- Coma, seizures

Cholinergic Toxidrome (DUMBBELS)

Muscarinic/nicotinic signs, CNS effects

- Diarrhea
- Urination
- Miosis
- Bronchorrhea, Bronchospasm, Bradycardia
- Emesis
- Lacrimation
- Salivation

Opioid Toxidrome

- CNS depression
- Miosis
- RD/apnea
- Bradycardia

Low BP & HR

- B-blockers
- Calcium Channel Blockers
- Digoxin
- Narcotics

COMA Toxins (Lethargic)

- Lead, Lithium
- Ethanol, Ethylene glycols
- TCAs, Toluene
- Heroin, Heavy metals, Hypoglycemics
- Antidepressants, Anticonvulsants, Antipsychotics, Antihistamines
- Risperidone
- GHB
- INH, Insulin
- Carbon monoxide, Cyanide, Clonidine

Sympathomimetic Toxidrome

- Lead, Lithium
- Ethanol, Ethylene glycols
- TCAs, Toluene
- Heroin, Heavy metals, Hypoglycemics
- Antidepressants, Anticonvulsants, Antipsychotics, Antihistamines
- Risperidone
- GHB
- INH, Insulin
- Carbon monoxide, Cyanide, Clonidine

High anion gap metabolic acidosis (MUDPILES)

- Methanol
- Uremia
- DKA
- Phenols
- Iron/Isoniazid
- Lactate
- Ethanol
- Salicylates

Do not give activated charcoal – (CHEMICAL CP)

- Caustics
- Hydrocarbons
- Electrolytes
- Metals
- Iron
- Cyanide
- Alcohols
- Lithium
- Camphor
- Phosphorous

Seizure Toxins (OTIS CAMPBELL)

- Organophosphates
- TCA
- INH
- Sympathomimetics
- Camphor
- Amphetamines
- Methylxanthines
- PCP, Propranolol, Phenol
- Benzodiazepines withdrawal
- Lithium, Lead, Lidocaine, Lindane

ONE PILL CAN KILL

- Cardiovascular drugs (B-blockers, Calcium channel blockers)
- Antidepressants
- Antipsychotics
- Anticonvulsants
- Antiarrhythmics
- Salicylates
- Oral hypoglycemic agents
- Opioids

Consult toxicology at +965 24771779

Acute Acetaminophen Ingestion

Toxic Single dose: more than or equal to 150 mg/kg or 7.5 g regardless of the weight

SYMPTOMS (START IN STAGE 2: 24 TO 72 HOURS AFTER OVERDOSE)

- RUQ pain, hepatic tenderness +/- hepatomegaly
- Hepatotoxicity (increased liver enzymes, increased PT or INR)
- Nephrotoxicity (oliguria, increased urea, increase in creatinine) in severe cases
- Increase in amylase, lipase +/- clinical pancreatitis

ABC

Check if the child has any risks for hepatotoxicity:

- Fasting or malnutrition
- Co-ingestion of other drugs (esp. trimethoprim/sulfamethoxazole, or rifampicin)
- Underlying medical conditions or liver disease)

<4 hours since ingestion

Within the first hour:

- **Activated charcoal (PO)** 1g/kg (max 50g/dose) unless contraindications (GI obstruction or altered mental status with unprotected airway)
- Gastric lavage NOT recommended

If unknown dose, charcoal not recommended

>4 hours since ingestion

Urgent Paracetamol level + plot on nomogram (refer to the next page)

If within toxic range, start antidote: N-acetylcysteine (NAC)

Oral NAC 72 hr course

- Loading NAC orally 140mg/kg followed by 17 doses of 70mg/kg every 4 hrs (total 1330mg/kg, total treatment time 17 hrs)
- To help tolerance, dilute to 5% solution in cola or juice, covering the cup & drink with straw, or may use ondansetron which often facilitates administration
- If vomits within 60 minutes, oral dose should be repeated
- If persistent vomiting despite ondansetron, IV NAC is indicated

Stop NAC if: asymptomatic, undetectable paracetamol level or serum transaminases are back to normal (<50% of the peak value)

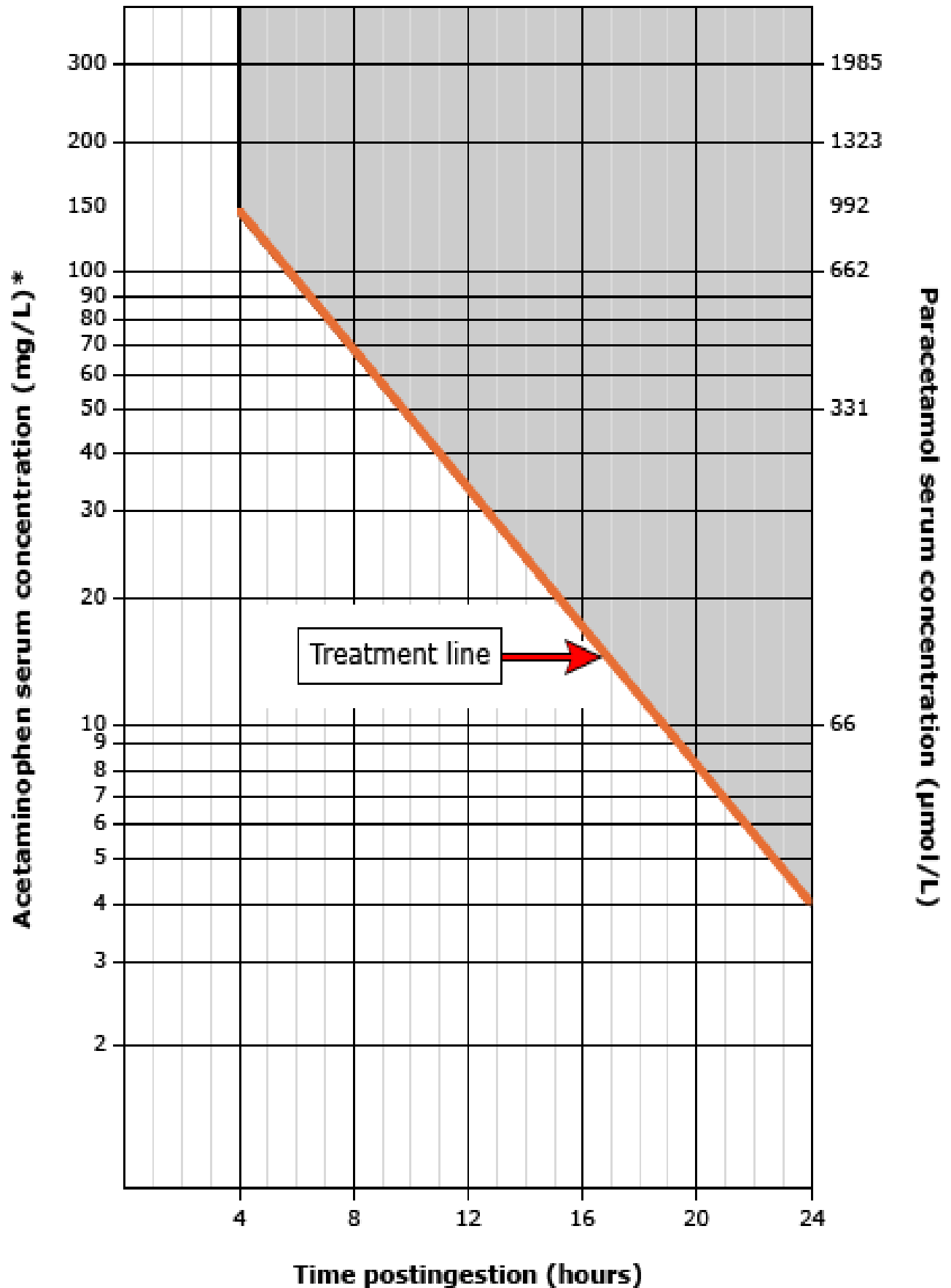
IV NAC: 21 hr regimen (UK regimen) (dilute with D5% + 1/2NS)

Indications: intractable vomiting, CI to oral administration, hepatic failure, refusing oral

	Loading dose	2 nd dose	3 rd dose
Dose	150mg/kg	50mg/kg	100mg/kg
Duration	Over 1 hour	Over 4 hrs	Over 16 hrs
Dilution	D5W	D5W	D5W
>40 kg	200 ml	500 ml	1000 ml
30 kg	100 ml	250 ml	500 ml
25 kg	100 ml	250 ml	500 ml
20 kg	60 ml (3ml/kg)	140 ml (7ml/kg)	280 ml (14ml/kg)
15 kg	45 ml (3ml/kg)	105 ml (7ml/kg)	210 ml (14ml/kg)
10 kg	30 ml (3ml/kg)	70 ml (7ml/kg)	140 ml (14ml/kg)

Total dose administered 300mg/kg over 21 hrs

Acute Acetaminophen Ingestion



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Organophosphate and Carbamate Ingestion

Acute Toxicity

Generally, manifests in minutes to hours (oral and respiratory manifestations within ~3hrs – dermal exposure manifestation up to 12hrs)

SLUDGE/BBB = Salivation, Lacrimation, Urination, Diarrhea, Gastric Emptying, Bradycardia, Bronchorrhea, Bronchospasm.

Muscle weakness, decreased central drive, increased secretions, and bronchospasm can lead to respiratory insufficiency

ABC's

- Deliver 100% oxygen via non-rebreathing mask; early intubation often required; **AVOID succinylcholine**
- Adequate volume resuscitation with isotonic crystalloid (e.g., normal saline or lactated ringer solution) should be performed concomitantly with other resuscitative and diagnostic efforts.

Decontamination

- May consider single dose activated charcoal 1 g/kg (Maximum dose 50 g) if oral ingestion within 1 hour, patient is stable and able to protect their airway (i.e. cooperative patient).
- Aggressive dermal decontamination (skin is washed with water and soap) and ocular irrigation as needed + bag/discard clothing
- NB: - healthcare workers must take precautions as they may get exposed

Atropine

0.05 -0.1mg/kg IV

If no effect, escalate (double) dose every 3-5 minutes until bronchial secretions and wheezing stop

Tachycardia and mydriasis are not contraindications to atropine use

Atropine toxicity: e.g., fever, muscle twitching, agitation, lethargy, swelling.

Inhaled ipratropium (Atrovent) 500mcg with parenteral atropine may be helpful for bronchospasm; may repeat.

Pralidoxime should be given with atropine

Pralidoxime

25 -50mg/kg in children IV in 100ml NS by infusion over 30 minutes; may repeat after 30 minutes or give continuous infusion if severe at 10-20 mg/kg/hour in children

OR 50% of initial dose may be infused over 2mins followed by 30mins of the remaining dose

If no IV access, give IM 15 mg/kg in children <40 kg. Rapidly repeat as needed to a total of 45 mg/kg

Diazepam (valium) IV

0.1to 0.2 mg/kg in children, repeat as necessary if seizures occur. **AVOID** phenytoin.

Max dose for diazepam:

For < 5 years → 5 mg

For ≥ 5 years → 10 mg

Call PICU (For atropine infusion/respiratory support if intubated)

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Signs & Symptoms of Acute Hydrocarbon Exposure

Signs & Symptoms (the type of hydrocarbon and the route/amount of exposure determine signs and symptoms):

Vital signs: Tachypnoea, tachycardia, ↓SpO₂, fever

Respiratory: Choking, cough, wheeze, cyanosis, respiratory compromise, chemical pneumonitis

CNS: CNS depression, seizures, euphoria and coma

Cardiac: Arrhythmias

GI: Esophagitis and hematemesis

Hydrocarbons are found in:

-Petroleum distillates (Kerosene, gasoline, mineral seal oils and naphtha, e.g., furniture polish, lighter fluids, lamp oil)

-Turpentine (often used as paint thinner) and pine oil

-Aromatic hydrocarbons (Benzene, Toluene, Xylene). They are used in solvents, glues, nail polish, paints, and paint removers.

* For ALL patients: **External Decontamination** – remove contaminated clothes, clean affected hair and skin (wash with water and soap), copious water irrigation of eyes as indicated.

AVOID activated charcoal and **AVOID** induced emesis
(Risk of aspiration)

Asymptomatic

Keep NPO and under observation for 4-6 hours

May be discharged if:

- Asymptomatic + normal CXR obtained ≥4hrs after exposure
- Asymptomatic +mildly abnormal CXR with no symptoms of hypoxemia during observation period
- AND** can receive timely OPD follow-up the next day.

Admission if:

- Symptomatic
- Intentional ingestion
- Mental health evaluation
- CXR shows evidence of chemical pneumonitis

Symptomatic

Ensure **ABCs**, oxygen as needed to prevent hypoxemia
Obtain intravenous access
ECG, CXR, CBC, RFT, LFT, ABG

Respiratory

- If wheezing, give SABA
- If hypercarbic respiratory failure/CNS depression:→ Intubation & ventilation
- If pneumonitis:**
- NPO + maintenance IVF
- Antibiotics if signs of secondary infection:
 - Recurrence of fever + leucocytosis 48 hrs post-exposure,
 - Increasing CXR infiltrates
 - Positive sputum/tracheal bacterial culture
- AVOID** prophylactic use of antibiotics.
- AVOID** corticosteroid (may be harmful)

CNS

- If seizures:
 - Give Benzodiazepines + aggressively treat hypoxia
- AVOID** Phenytoin in case of status epilepticus (arrhythmogenic)
- Follow status epilepticus guidelines.

Cardiac

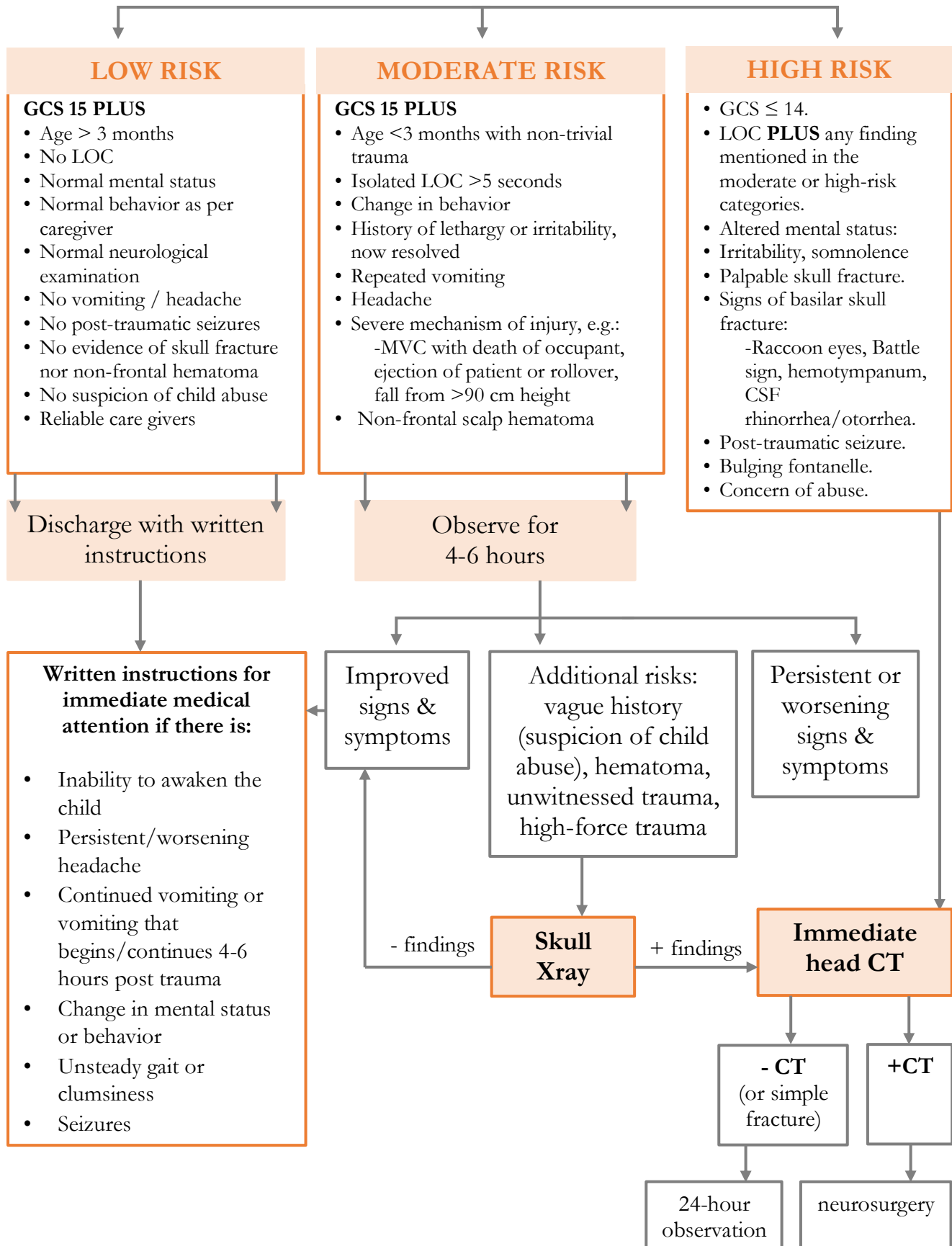
- If arrhythmia/VF:** Correct electrolytes (Mg⁺, K⁺)
- VF/ pulseless VT→ consider early **lidocaine** instead of epinephrine
 - o Lidocaine 1 mg/kg followed by I.V. infusion rate 20 – 50 mcg/min. May use B-blocker.
- AVOID** Epinephrine (cardiac sensitization to catecholamine leads to ventricular arrhythmias)
- refer to VF algorithm (CPR/Defibrillator).

Consult toxicology at +965 24771779

According to CATCH rules

Definition: History or physical signs of blunt trauma to the head in an infant who is alert or awakens to voice or light touch (i.e. GCS: 14-15)

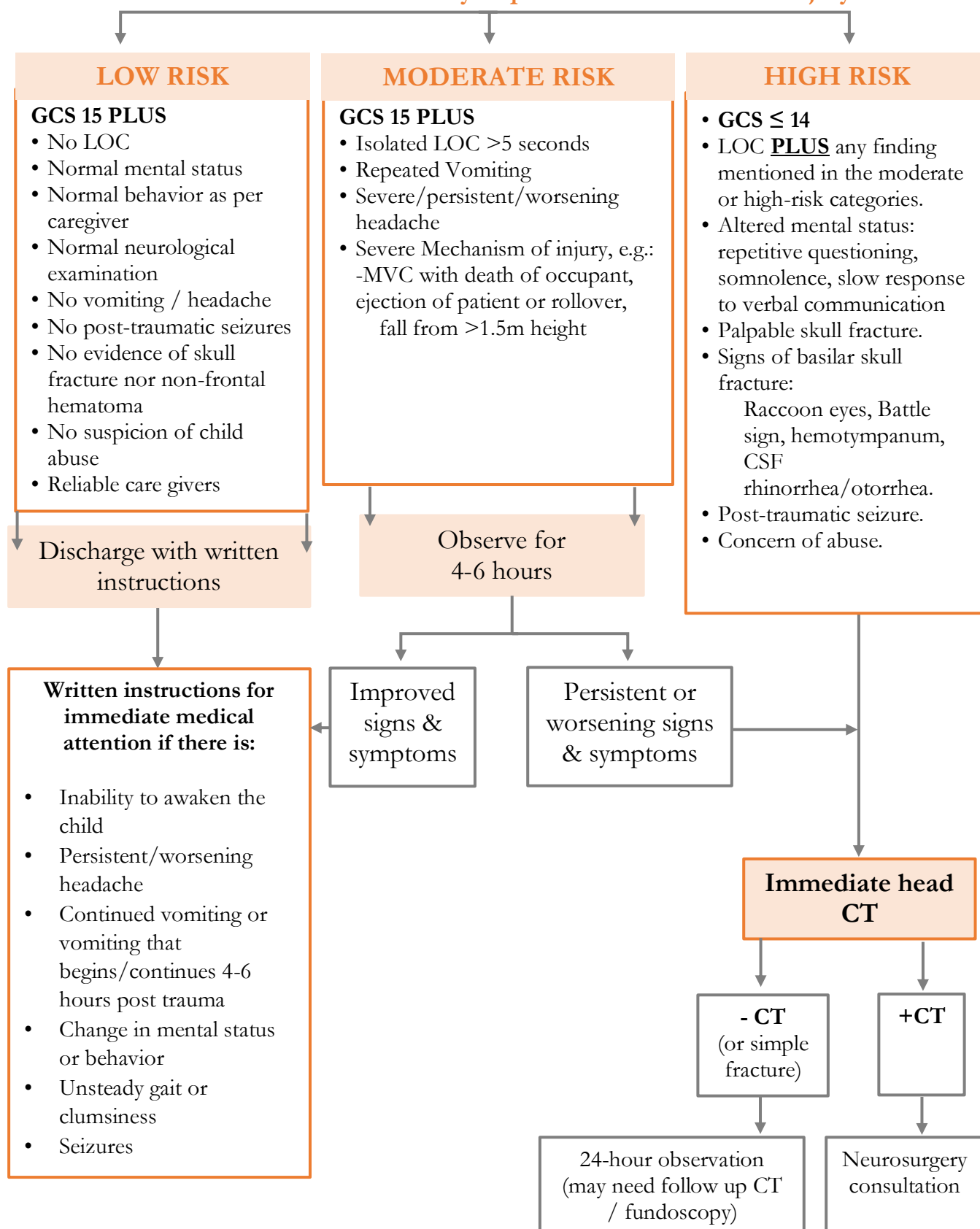
Risk classification for clinically important traumatic brain injury



According to CATCH rules

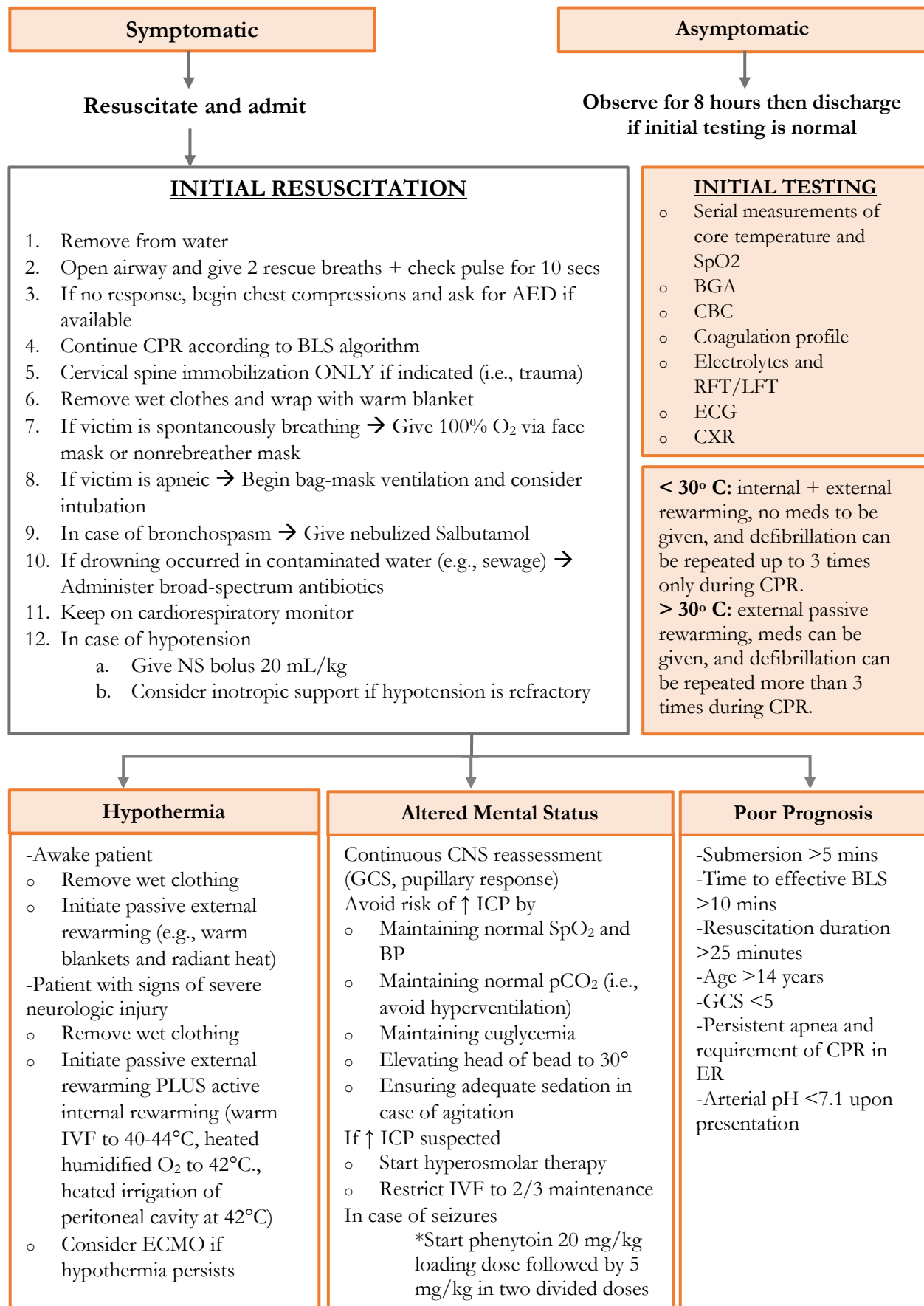
Definition: GCS 14-15 PLUS no abnormal/focal findings on neurological examination, and no physical evidence of skull fracture

Risk classification for clinically important traumatic brain injury



Drowning (Submersion)

Definition: The process of experiencing respiratory impairment from submersion or immersion in liquid



Primary Survey: ABCDE

AIRWAY	BREATHING	CIRCULATION	DISABILITY	EXPOSURE
<ul style="list-style-type: none"> - Check for signs of airway burn (if any present, consider early intubation) • Stridor • Hoarseness • Black sputum • Singed facial hair • Facial congestion - Apply high flow oxygen, if CO poisoning is suspected. - Nebulized Salbutamol for signs of bronchospasm. 	<ul style="list-style-type: none"> - Evaluate respiratory effort and if the patient requires intubation. • Check for restricted chest expansion and consider escharotomy. 	<ul style="list-style-type: none"> - Check for signs of shock. <ul style="list-style-type: none"> • Tachycardia • Poor perfusion • Hypotension - Obtain IV/IO access (preferably 2). - Start IV fluid resuscitation as per circulation status then requirements. • Obtain 12 lead ECG (in electrical burns). 	<ul style="list-style-type: none"> - Check for altered LOC and consider airway support. • Assess neurovascular status if the limbs are involved. 	<ul style="list-style-type: none"> - Remove clothing and visualize affected areas. • Assess burn depth, do not include areas with epidermal burn.

Call PICU/anesthesia if oropharyngeal or significant burns for early intubation

Secondary Survey

Head to toe examination.

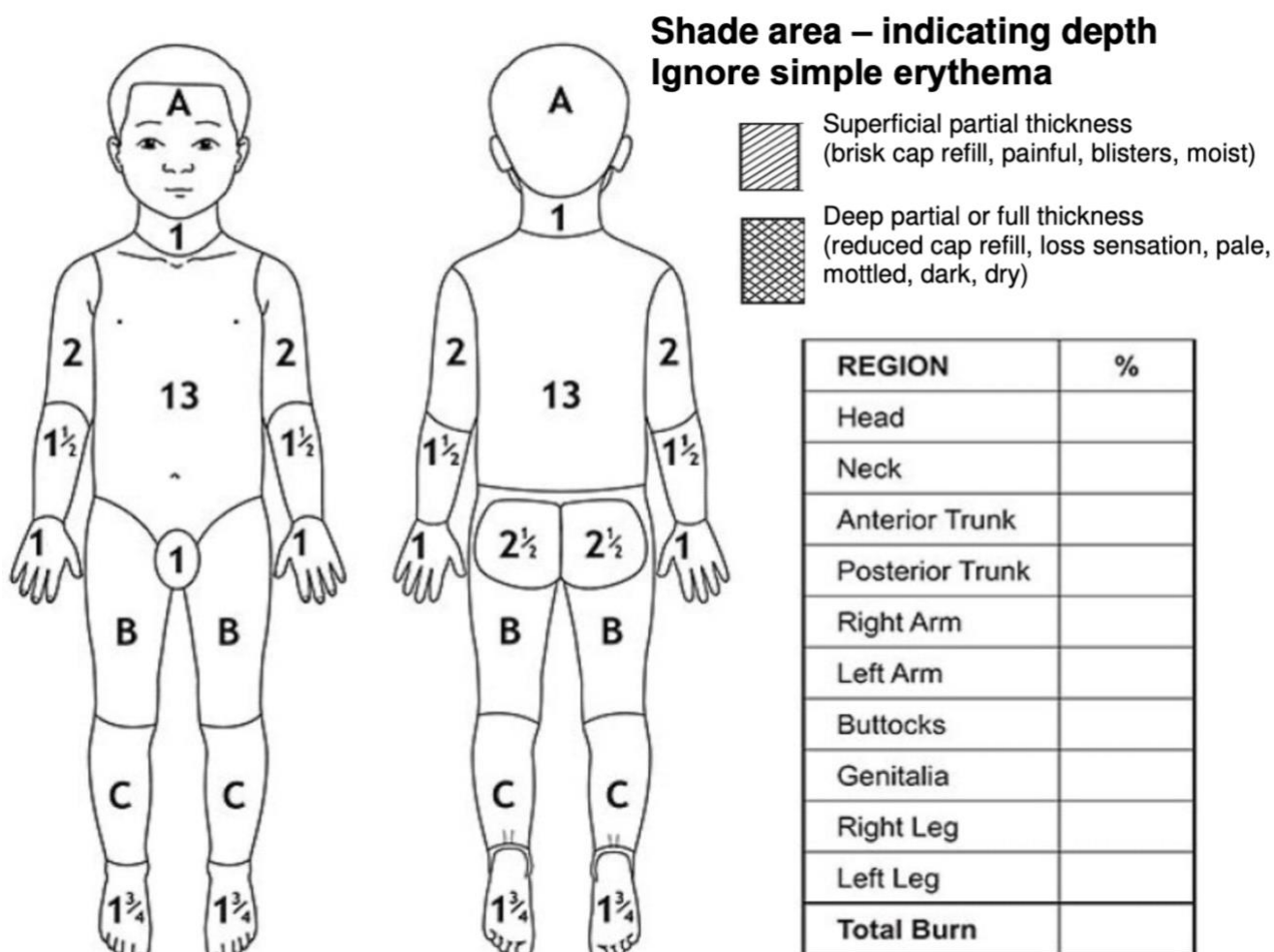
Detailed history.

Immediate burn care-remove clothes that are hot/burned or exposed to chemicals and constricting jewelry etc., copious irrigation of affected area with normal saline for 1st & 2nd degree burns, & chemical burn.

FLUID RESUSCITATION AND TBSA

- Keep the patient NPO.
- Use Ringer lactate solution, if it is not available use 0.9% NS.
- Insert a urinary catheter for strict fluid balance.
- Start with 20 ml/kg IV fluid bolus before applying the Parkland formula by assessing body surface area.
- Use the Lund Browder chart or patients palm (palm represents 1% of BSA) to assess body surface area involved. (Use charts and diagrams in following pages)
 - o Note: not applicable for first degree burns
- Monitor response to fluid resuscitation via mental status, skin perfusion, age-appropriate HR and BP +catheterized urine output (aim for: 0.5-1 ml/kg/hour)

Lund Browder chart (TSBA % Assessment)



Relative percentage of body surface area affected by growth.

Age (years)	0	1	5	10	15	Adult
A 1/2 of head	9 1/2	8 1/2	6 1/2	5 1/2	4 1/2	3 1/2
B 1/2 of one thigh	2 3/4	3 1/4	4	4 1/2	4 1/2	4 3/4
C 1/2 of one leg	2 1/2	2 1/2	2 3/4	3	3 1/4	3 1/2

Small burns - Palm of hand (including fingers together) approximates 1% of body surface area.
 Palm alone approximates 0.5% BSA.

RIGHT SIDE					
LEFT SIDE					

Modified Parkland Formula

Correct use of this formula uses 5 steps:

TBSA = **A** %
 Weight = **B** kg
 Time since burn = **C** hrs (If more than 7 hrs, use 7)
 Volume fluid already received = **D** ml

Step 1: Calculate estimated fluid required in the first 24 hours (from time the burn injury)

$$3 \times \text{A} \% \times \text{B} \text{ kg} = \text{E} \text{ ml}$$

Step 2: Adjust volume to account for initial fluids already received

$$\text{E} \text{ ml} - \text{D} \text{ ml} = \text{F} \text{ ml}$$

Step 3: Adjust volume to account for initially maximal increased vascular permeability

$$\text{F} \text{ ml} \div 2 = \text{G} \text{ ml}$$

Step 4: Adjust rate calculation to account for time elapsed since the burn injury

$$\text{G} \text{ ml} \div (8 - \text{C}) \text{ hrs} = \text{H} \text{ ml/hr}$$

Step 5: Start IV resuscitation fluids at rate **H** ml/hr

The MPF is to be used as a *guide* only and the patient's fluid state and urine output should be re-evaluated in 1 – 2 hours of commencing fluids and rate adjusted accordingly to target an optimal urine output of 1ml/kg/h:

- sustained urine output <1ml/kg/hr: increase fluid rate
- sustained urine output >1ml/kg/hr: decrease fluid rate

ANALGESIA

IV Acetaminophen (15 mg/kg/dose) q6h.
 IV Morphine (0.1 mg/kg/dose) q2h – q4h.

INITIAL INVESTIGATIONS

Major burns (> 10% TSBA): CBC, electrolytes, blood group, blood glucose, BGA, CK level

Suspected inhalation injury: BGA, carboxyhemoglobin, CXR, troponin

Electrical burns: ECG, troponin

OTHER MANAGEMENT

- Wound debridement by saline soaked gauze, silver sulphadiazine as topical antimicrobial
- Circumferential partial + full thickness burns may need escharotomy –consult surgeons
- Upper limb burns: immobilize with sling and splint
- Surgical consultation for moderate to severe burns
- NGT feeds if major burns - can start after 6-8hrs
- Tetanus status: vaccinate if more than a superficial burn in children who had the last vaccine >5years ago. Administer tetanus Ig if no or unknown primary immunizations
- Antibiotic prophylaxis not indicated unless clinical infection (burn sepsis, toxic shock) or positive wound culture

CLASSIFICATION OF BURNS

First degree (Superficial thickness)	Involves injury to the epidermis only. Not included in body surface area (BSA) calculations. Presents with erythema and extreme pain (e.g. sunburn) No blistering. Sensation is intact. Resolves in 3-5 days without scarring
Second degree (Partial thickness) <i>Superficial</i>	Injury to the epidermis and superficial dermis. Appears with thin blisters, erythematous, edematous and moist. Sensation is intact. Heals in 2-3 weeks without scarring.
Second degree (Partial thickness) <i>Deep</i>	Involves injury to epidermis and both superficial and deep dermis. Often intermixed with 3 rd degree burns. Appears dry or moist and pale or red. Thick ruptured blisters. Extreme pain or no pain (insensate). May have decreased 2-point discrimination. Heals in 3-6 weeks. Potential for scarring.
Third degree (Full thickness)	Involves injury to the epidermis and the entire dermis. Appears pale, charred, white and leathery. Minimal tenderness due to the destruction of dermal pain receptors. Skin grafting is always necessary.
Fourth degree	These burns involve deep injury to muscle, fascia and bone.

Consider transfer to a burn center if:	Indication for admission to local hospital for observation, IV fluids and pain management:
<ul style="list-style-type: none"> - 10% of TSBA. - All full thickness burns - Special areas: face, eyes, ears, neck, hands, feet, genitalia, perineum or a major joint, even if < 10%. - Circumferential burns - Chemical burns - Electrical burns - Associated with trauma or spinal cord injury. - All inhalation/airway. - Children < 12 months. 	<ol style="list-style-type: none"> 1. Age <10yrs with 5-10%TSBA burn (depending on parental capability and social circumstances) 2. Age ≥10yrs with 10-20%TBSA burn if local ped. surgical expertise available 3. Full thickness burns 2-5%TBSA, if local ped. surgical expertise available 4. Circumferential burns 5. Medical problems predisposing to infection (DM, sickle cell) 6. Concern for inflicted injury

Drug	Indications/dosages	Max Dose
Adenosine	<ul style="list-style-type: none"> • SVT: <ul style="list-style-type: none"> o First dose: 0.1 mg/kg IV/IO rapid push o Second dose: 0.2 mg/kg IV/IO rapid push 	1st dose: max 6 mg 2nd dose: max 12 mg
Albuterol	<ul style="list-style-type: none"> • Asthma, anaphylaxis (bronchospasm), hyperkalemia: <ul style="list-style-type: none"> o MDI: 4 to 8 puffs via inhalation q 20 minutes PRN with spacer (or ET if intubated) o Nebulizer: inhalation q 20 minutes PRN <ul style="list-style-type: none"> • WT < 20Kg: 2.5 mg/dose • WT > 20Kg: 5 mg/dose o Continuous nebulizer: 0.5 mg/kg/hr via inhalation 	Continuous Neb: max 20 mg/h
Amiodarone	<ul style="list-style-type: none"> • SVT, VT (<i>with pulses</i>): <ul style="list-style-type: none"> o 5 mg/kg IV/IO load over 20 to 60 minutes, repeat to daily max • Pulseless arrest (<i>ie, VF/pulseless VT</i>): <ul style="list-style-type: none"> o 5 mg/kg IV/IO bolus, repeat to daily max 	Max Single Dose: 300 mg Daily Max: Child: 15mg/kg Adolescent: 2.2 gm
Atropine sulfate	<ul style="list-style-type: none"> • <u>Symptomatic</u> bradycardia: <ul style="list-style-type: none"> o IV/IO: 0.02 mg/kg. May repeat dose once in 5 minutes, until max total dose. o ET: 0.04 to 0.06 mg/kg • Toxins/overdose (<i>eg, organophosphate, carbamate</i>): <ul style="list-style-type: none"> o <12 years: 0.05 mg/kg IV/IO initially; then repeat and double the dose every 5 minutes until muscarinic symptoms reverse o ≥12 years: 1 mg IV/IO initially; then repeat and double the dose every 5 minutes until muscarinic symptoms reverse 	Max single: dose 0.5 mg Max total dose: Child: 1 mg Adolescent: 3 mg
Calcium chloride 10%	<ul style="list-style-type: none"> • Hypocalcemia, hyperkalemia, hypermagnesemia, calcium channel blocker overdose: <ul style="list-style-type: none"> o 20 mg/kg (0.2 mL/kg) IV/IO slow push during arrest, repeat PRN 	
Calcium gluconate	<ul style="list-style-type: none"> • Hypocalcemia, hyperkalemia, hypermagnesemia, calcium channel blocker overdose: <ul style="list-style-type: none"> o 60 mg/kg (0.6 mL/kg) IV/IO slow push during arrest; repeat PRN 	

Dexamethasone	<ul style="list-style-type: none"> • Croup: <ul style="list-style-type: none"> o 0.6 mg/kg PO/IM/IV • Asthma: <ul style="list-style-type: none"> o 0.6 mg/kg PO/IM/IV every 24 hours 	Max dose: 16 mg
Dextrose (glucose)	<ul style="list-style-type: none"> • Hypoglycemia: <ul style="list-style-type: none"> o 0.5 to 1 g/kg IV/IO (D25W 2 to 4 mL/kg; D10W 5 to 10 mL/kg) 	
Epinephrine	<ul style="list-style-type: none"> • Pulseless arrest, <u>symptomatic</u> bradycardia: <ul style="list-style-type: none"> o IV/IO: 0.01 mg/kg (0.1 mL/kg of the 0.1 mg/mL concentration) q 3 to 5 minutes o ET: 0.1 mg/kg (0.1 mL/kg of the 1 mg/mL concentration) q 3 to 5 minutes • Hypotensive shock: <ul style="list-style-type: none"> o 0.1 to 1 mcg/kg per minute IV/IO (consider higher doses if needed). 	Max single dose: IV/IO: 1 mg
Epinephrine	<ul style="list-style-type: none"> • Anaphylaxis: <ul style="list-style-type: none"> o IM autoinjector: <ul style="list-style-type: none"> • WT 10-30 kg: 0.15 mg junior autoinjector • WT ≥30 kg: 0.3 mg IM o IM: 0.01 mg/kg (0.01 mL/kg of the 1 mg/mL concentration) q 15 minutes PRN o IV/IO: 0.01 mg/kg (0.1 mL/kg of the 0.1 mg/mL concentration) q 3 to 5 minutes <u>if hypotensive</u> o IV/IO infusion: 0.1 to 1 mcg/kg/minute <u>if hypotension persists despite fluids and IM injection</u> • Croup: <ul style="list-style-type: none"> o 0.25 to 0.5 mL racemic solution (2.25%) mixed in 3 mL NS via inhalation o 3 mg (3 mL of the 1 mg/mL concentration) epinephrine mixed with 3 mL NS (which yields 0.25 mL racemic epinephrine solution) via inhalation 	Max single dose: IM: 0.3 mg IV/IO: 1 mg SC: 0.3 mg or 0.3 mL
Etomidate	<ul style="list-style-type: none"> • RSI: <ul style="list-style-type: none"> o 0.2 to 0.4 mg/kg IV/IO infused over 30 to 60 seconds will produce rapid sedation that lasts for 10 to 15 minutes 	Max: 20 mg

Hydrocortisone	<ul style="list-style-type: none"> • Adrenal insufficiency: <ul style="list-style-type: none"> o 2mg/kg IV bolus 	Max: 100 mg
Ipratropium bromide	<ul style="list-style-type: none"> • Asthma: <ul style="list-style-type: none"> o 250 to 500 mcg via inhalation q 20 minutes PRN × 3 doses 	
Lidocaine	<ul style="list-style-type: none"> • VF/pulseless VT, wide-complex tachycardia (<i>with pulses</i>): <ul style="list-style-type: none"> o IV/IO: <ul style="list-style-type: none"> • <i>Bolus:</i> 1 mg/kg • <i>Maintenance infusion:</i> 20 to 50 mcg/kg/minute IV/IO (repeat bolus dose if infusion initiated >15 minutes after initial bolus) o ET: 2 to 3 mg/kg 	
Magnesium sulfate	<ul style="list-style-type: none"> • Asthma (<i>refractory status asthmaticus</i>), torsades de pointes, hypomagnesemia: <ul style="list-style-type: none"> o Pulseless VT (torsades de pointes): 25 to 50 mg/kg IV/IO bolus. o VT with pulses (torsades de pointes): 25 to 50 mg/kg IV/IO over 10 to 20 minutes. o Status asthmaticus: 50 mg/kg IV/IO slow infusion over 15 to 30 minutes. 	Max: 2 grams
Methylprednisolone	<ul style="list-style-type: none"> • Asthma (<i>status asthmaticus</i>): <ul style="list-style-type: none"> o Load: 2 mg/kg IV/IO/IM; only use acetate salt IM o Maintenance: 0.5 mg/kg IV/IO q 6 hours 	Max: 60 mg loading dose
Milrinone	<ul style="list-style-type: none"> • Myocardial dysfunction and increased SVR/PVR <ul style="list-style-type: none"> o Loading dose: 50mcg/kg IV/IO over 10-60 min followed by 0.25-0.75 mcg/kg per minute IV/IO infusion 	
Naloxone	<ul style="list-style-type: none"> • Total narcotic reversal required (for narcotic toxicity secondary to overdose): 0.1 mg/kg IV/IO/IM/subcutaneous bolus q 2 minutes PRN • Total reversal not required (eg, for respiratory depression associated with therapeutic narcotic use): 1 to 5 mcg/kg IV/IO/IM/subcutaneously; titrate to desired effect • Maintain reversal: 0.002 to 0.16 mg/kg per hour IV/IO infusion 	Max: 2 mg

Nitroglycerin	Heart failure, cardiogenic shock: <ul style="list-style-type: none"> Children: Initiate at 0.25 to 0.5 mcg/kg per minute IV/IO infusion; titrate by 1 mcg/kg per minute q 15 to 20 minutes as tolerated. Typical dose range 1 to 5 mcg/kg per minute Adolescents: Start with 5 to 10 mcg per minute (<i>not per kilogram per minute</i>) and increase to max 200 mcg per minute 	Max: 10 mcg/kg/min
Nitroprusside	<ul style="list-style-type: none"> Cardiogenic shock (<i>ie, associated with high SVR</i>), severe hypertension: 0.3 to 1 mcg/kg per minute initial dose; then titrate up to 8 mcg/kg per minute PRN 	
Norepinephrine	<ul style="list-style-type: none"> Hypotensive (<i>usually distributive</i>) shock (<i>ie, low SVR and fluid refractory</i>): 0.05 to 2 mcg/kg per minute IV/IO infusion; titrate to desired effect 	
Prostaglandin E ₁ (PGE ₁)	<ul style="list-style-type: none"> Ductal-dependent congenital heart disease (<i>all forms</i>): <ul style="list-style-type: none"> 0.05 to 0.1 mcg/kg per minute IV/IO infusion initially; then 0.01 to 0.05 mcg/kg per minute IV/IO 	
Sodium bicarbonate	<ul style="list-style-type: none"> Metabolic acidosis (<i>severe</i>), hyperkalemia: <ul style="list-style-type: none"> 1 mEq/kg IV/IO slow bolus Sodium channel blocker overdose (<i>eg, tricyclic antidepressant</i>): <ul style="list-style-type: none"> 1 to 2 mEq/kg IV/IO bolus until serum pH is >7.45 (7.50 to 7.55 for severe poisoning) followed by IV/IO infusion of 150 mEq NaHCO₃/L solution titrated to maintain alkalosis 	
Vasopressin	<ul style="list-style-type: none"> Catecholamine-resistant hypotension: <ul style="list-style-type: none"> 0.0002 to 0.002 unit/kg per minute (0.2 to 2 milliunits/kg per minute) continuous infusion 	

DRUG	INFUSION RATE
Dopamine	<ul style="list-style-type: none"> • 2 – 20 mcg/kg/min
Dobutamine	<ul style="list-style-type: none"> • 2 – 20 mcg/kg/min
Epinephrine	<ul style="list-style-type: none"> • 0.1–1 mcg/kg/min
Prostaglandin E1	<ul style="list-style-type: none"> • 0.05–0.1 mcg/kg/min
Morphine	<ul style="list-style-type: none"> • 10 – 40 mcg/kg/hr

Vaccination Schedule 2019

Age	Vaccine Type	Route
Pregnant mother	• 2 doses of Tetanus toxoid at 5th & 7th month of 1st Pregnancy	• I.M
Within 24 hrs of birth	• 1st dose of Hepatitis B (HBV)	• I.M
End of 2nd month	• 1st dose of IPV (Salk) • 1st dose of DPT/Hib/HBV* (Pentavalent) • 1st dose of Pneumococcal (PCV13) • 1st dose of Rota	• I.M • I.M • I.M • Oral
End of 3rd month	• BCG vaccine	• I.D
End of 4th month	• 2nd dose of IPV (Salk) • 2nd dose of DPT/Hib/HBV (Pentavalent) • 2nd dose of Pneumococcal (PCV13) • 2nd dose of Rota	• I.M • I.M • I.M • Oral
End of 6th month	• 3rd dose of IPV (Salk) • 3rd dose of DPT/Hib/HBV (Pentavalent) • 3rd dose of Pneumococcal (PCV13) • 3rd dose of Rota**	• I.M • I.M • I.M • Oral
End of 12 months	• 1st dose of OPV • 1st dose of MMR vaccine • 1st dose of Varicella vaccine • Conjugate Meningitis	• Oral • S.C • S.C • I.M
At 18th month	• 2nd dose of OPV • Booster dose of DPT/Hib/HBV (Pentavalent) • Booster dose of Pneumococcal (PCV13)	• Oral • I.M • I.M
End of 2 years	• 2nd dose of MMR vaccine • 2nd dose of Varicella vaccine	• S.C • S.C
End of 3.5 years	• Booster dose of OPV • Booster dose of DPT	• Oral • I.M
4-6 years (Preschool)	Before school, the child's vaccination status should be checked and confirmed	
10-12 years (in school)	• Booster dose of MMR (Females only) • Booster dose of Td (Tetanus/Diphtheria)	• S.C • I.M
16-18 years (in school)	• Booster dose of Td (Tetanus/Diphtheria)	• I.M

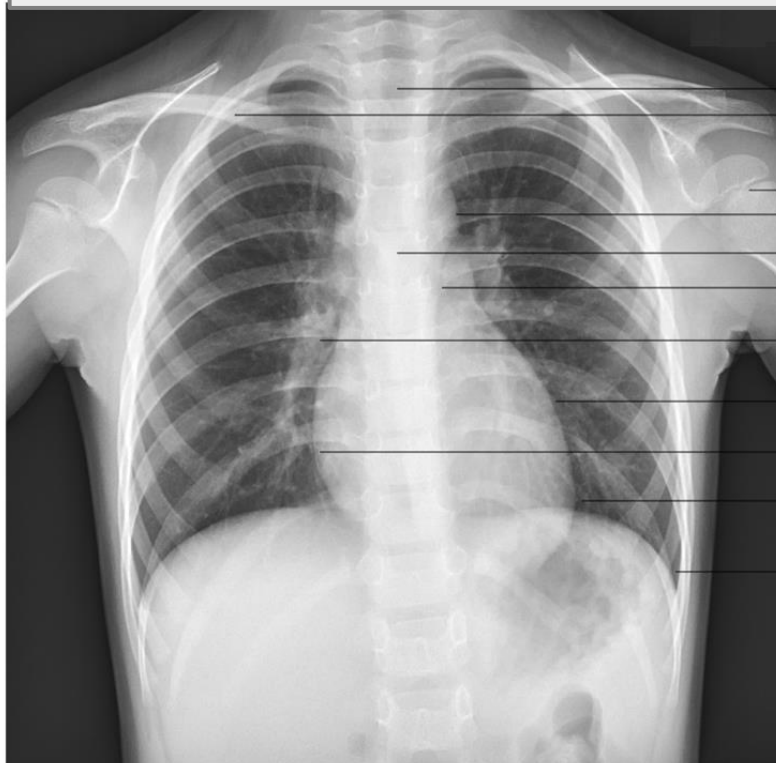
APPROACH TO CXR

1. Patient identification
2. CXR quality (rotation, inhalation, etc)
3. Tubes/lines
4. Lungs
5. Heart
6. Mediastinum
7. Diaphragm
8. Bony structures

How to check for full inspiratory effort?

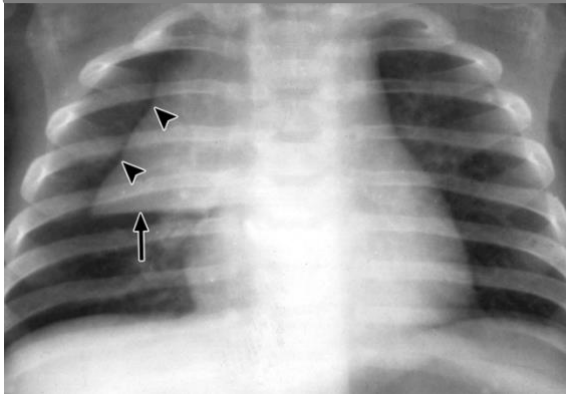
- 8 visible posterior ribs in ages 0-3
- 9 posterior ribs in ages 3-7 years
- 10 posterior ribs in children ages 7+

Normal CXR (4-year-old child)



- Trachea
- Clavicle
- Growth plate (Humerus)
- Aortic knob
- Carina
- Left main bronchus
- Right hilum
- Left ventricle border
- Right Atrium border
- Cardiophrenic angle
- Costophrenic angle

Thymus (5-month-old)



Note the “thymus sail sign” (arrow) and “thymic wave sign/ ripple” (arrowheads). The thymus can remain visible until 3 years of age.

Foreign body inhalation



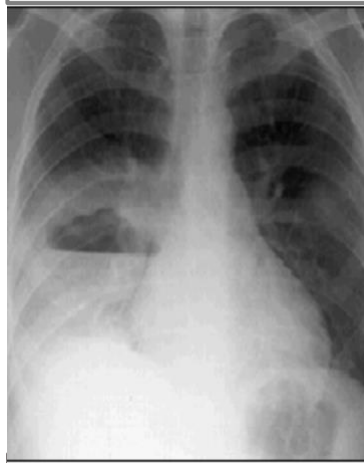
Expiration CXR; shows unilateral hyperinflation. Both inspiratory and expiratory CXRs should be obtained if possible.

Interstitial pneumonia



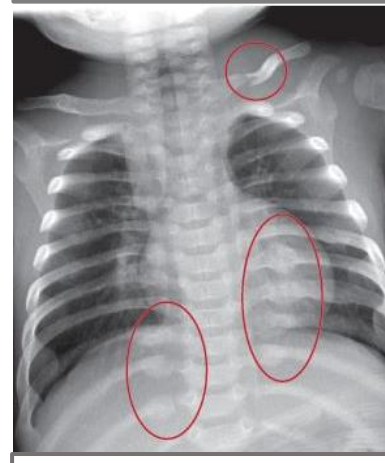
Diffuse bilateral interstitial infiltrates. In this case the child had *M. pneumoniae* infection.

Lung abscess



Note the air-fluid level in the right lung. A child with pneumococcal pneumonia complicated by an abscess.

Fracture



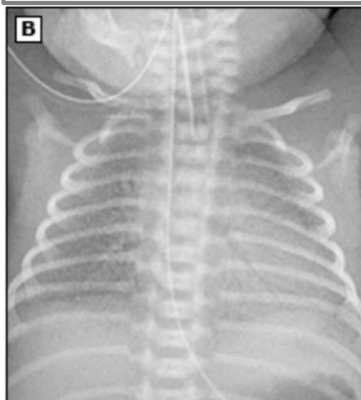
Posterior rib and clavicle fractures of different ages - suggestive of child abuse

Cardiomegaly



Child with a VSD: CXR shows prominent heart and pulmonary vasculature (active congestion).

Respiratory distress synd.



RDS CXR demonstrating low lung volume, diffuse ground glass appearance.

Lobar pneumonia



Right upper lobe consolidation

Appendix A- Changes Made in the Fifth Edition

Note: minor spelling corrections or minor editorial changes are not listed

1. References were added for each topic and can be found in *Appendix B*
2. Vital Signs
 - Changes were made to the heart and respiratory rates in order to match the American Heart Association © (2020) *Pediatric advanced life support: Reference card* for heart and respiratory rates
 - A footnote was added to clarify that the BP measurements listed were only rough measures and to refer to the appropriate charts for more accurate levels
3. Cardiac arrest algorithm
 - "...and capnography" was added after "consider intubation" in order to exactly match the algorithm in the PALS 2020 provider manual.
4. Pediatric Tachycardia with a Pulse
 - Minor changes were made in order to exactly match the algorithm in the PALS 2020 provider manual, including some reordering of text as well as correcting ">" to "≥"
5. Pediatric Bradycardia with a Pulse
 - Minor changes were made in order to exactly match the algorithm in the PALS 2020 provider manual, including adding "Monitor pulse, BP and oximetry" to *Assessment and Support* and making some changes to *Doses/Details*
6. Septic Shock
 - Changes were made under "initial stabilization"
 - A note was added that vasoactive medications can be started through a peripheral line with close observation
 - Emphasis was made on the role of non-invasive ventilation
 - Updates were made regarding stress hydrocortisone administration recommendations
 - Dilution instructions for vasoactive medications were removed
7. Rapid sequence intubation
 - Extensive changes were made to this topic, including sections added to give general background information on RSI and assessing for airway difficulty. Changes were made in medication options as well as some doses, with more detail included under each medication to identify when the medication is best used as well as precautions before use. Additionally, under protection and positioning, "carotid pressure" was corrected to "cricoid pressure"
8. Tet spell
 - Multiple changes were made to the algorithm, including administering oxygen early in the initial management steps, adding a section outlining management in the presence and in the absence of IV access, and consulting PICU was added to the algorithm, among other changes
9. Hypertensive crisis
 - Stages of hypertension were defined in a table
 - It was clarified that management should be tailored to underlying condition that caused elevated BP. Previously it had just recommended to "identify conditions that alter BP management."
 - Correction was made to initiate elevated ICP treatment and *not* wait to obtain neuroimaging first in the presence of suggestive clinical findings. Correction was also

made to consult neurosurgery for *complications* of elevated ICP/ mass effect/ bleeding and *not* for BP modifications as was previously mentioned.

10. Comatose child

- “start with ABCs” was corrected to “start with ABCDE”
- “If patient in respiratory failure or GCS $\leq 8 \rightarrow$ intubate” was changed to “intubate if necessary”
- Clarified that critical sample should be sent if RBS < 2.8 mmol/L
- Specified which cultures should be collected with the addition of “if indicated”
- “Signs of impending brain herniation” box was changed to “suspected \uparrow ICP” with content of the box changed accordingly
- “Respiratory distress” and “spinal abnormalities” were removed as contraindications for LP

11. Bronchiolitis

- Considering blood gasses and partial septic work up were added to inpatient management, and epinephrine trial was removed
- Discharge criteria were modified

12. Asthma

- Route of administration “nebulization” of Ventolin was removed to allow for administration by MDI
- “Considering alternate diagnosis”, “continuous nebulized ventolin”, and “IV steroids” instead of oral were added for severe asthma
- Removed RSI as it can be a cause of morbidity and mortality

13. Croup

- The dose of dexamethasone was corrected
- Early PICU consultation was added for severe cases

14. Neonatal Resuscitation

- Added that when a MR SOPA step results in chest movement, ventilate for 30 sec and reassess heart rate

15. Neonatal Jaundice

- Many changes were made in order to match the AAP guidelines, including addition of “neurotoxicity risk factors” and “escalation of care” as well as changes to the pre-existing sections
- Addition of figures showing phototherapy levels and exchange transfusion levels

16. Status epilepticus

- Clarified that algorithm should be applied to ages ≥ 3 months
- Several other changes were made to the algorithm, timing, and medication choices after extensive discussion with pediatric neurologist Dr Yousef AlHabib

17. Hypocalcemia

- An addition was made to clarify that ionized calcium is preferred over total serum calcium to guide assessment and management

18. Hyperkalemia

- Minor adjustments were made to the box describing ECG changes
- Note was made that in cardiac arrest/impending arrest, calcium chloride is typically used rather than calcium gluconate due to its more rapid effect
- Adjustment was made to sodium polystyrene sulfonate’s onset of effect and a note was made regarding its potentially minimal benefit in the acute setting

19. Hypokalemia chapter was added

20. Sodium pages

- 200ml was written instead of 20ml in the example for symptomatic hyponatremia correction
- Hyponatremia correction fluid was changed from “normal saline alone” to 0.9%Nacl +D5%
- Hyponatremia fluid correction: 0.9% normal saline + D5% was added as an option in replacement fluid choice with an added emphasis on frequent monitoring of Na level during correction

21. DKA

- Under “insulin”, use of SC insulin in DKA was removed to avoid confusion
- KCl dosing in mEq was added
- Phosphorous correction was removed to avoid confusion

22. Anaphylaxis

- Corrections were made to medication choices as well as dosing

23. Neonatal fever (0-21 days) and (22-28 days), Well and Ill Febrile infant (29-90 days), and Fever without focus (3-36 months) page 40-44

- Minor changes were made in the algorithms for the for the purpose of clarification

24. Toxicology pages

- Toxicology center in kuwait contact number was added for reference on toxic ingestion pages

25. Minor head trauma > 2 years was corrected to “≥ 2 years”

26. Emergency medications

- A few changes were made in order to match the American Heart Association ©. (2020). *Pediatric advanced life support: Reference card*

27. Infusions

- Corrections were made to the doses, and the infusion preparation steps were omitted to avoid confusion and due to different protocols in different hospitals. Infusions should be prepared according to your hospital protocol.

Appendix B- References

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 - o Fractures image: British Columbia medical journal
 - o Cardiomegaly: radiopaedia.org
 - o Lung abscess image: uptodate.com

Appendix C- Credits and Contributions

- 1- Pediatric cardiac arrest
 - Written by Dr Khalaf AlShammari
 - Adapted from *PALS 2020*
- 2- Tachycardia with a pulse
 - Written by Dr Khalaf AlShammari
 - Adapted from *PALS 2020*
- 3- Bradycardia with a pulse
 - Written by Dr Khalaf AlShammari
 - Adapted from *PALS 2020*
- 4- Septic shock
 - Written by Dr Saja AlShemmeri
 - Reviewed by Dr Ahmad AlMousawi
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 5- Rapid sequence intubation
 - Written by Dr Saja AlShemmeri
 - Reviewed by Dr Ahmad AlMousawi
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 6- Tet spell
 - Written by Dr Saja AlShemmeri
 - Reviewed by Dr Tinikar
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 7- Hypertensive crisis
 - Written by Dr Raghda AlJassar
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 8- Comatose child
 - Written by Dr Noura AlAyadhi and Dr Salman AlAsfour
 - Reviewed by Dr Hussein Sadeq
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 9- Status epilepticus
 - Written by Dr Dana AlSharrah
 - Reviewed by Dr Yousef AlHabib
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 10- Bronchiolitis
 - Written By Dr Khaled AlAffasy
 - Reviewed by Dr Sarah AlJamaan
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 11- Asthma
 - Written By Dr Khaled AlAffasy
 - Reviewed by Dr Sarah AlJamaan
- Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 12- Croup
 - Written By Dr Khaled AlAffasy
 - Reviewed by Dr Sarah AlJamaan
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 13- Neonatal resuscitation
 - Written by Dr Mariam AlRoumi
 - Adapted from *NRP 2021*
 - Reviewed by Dr Fawaz AlBaghli
- 14- Newborn hypoglycemia
 - Written by Dr Mariam AlRoumi
 - Reviewed by Dr Ghanim AlGhanim
- 15- Neonatal jaundice
 - Written by Dr Mariam AlRoumi
 - Reviewed by Dr Fawaz AlBaghli
- 16- Metabolic emergency (1st presentation)
 - Written by Dr Hind AlFaraj
 - Reviewed by Dr Amirah AlKandari and Dr Nawal Makhseed
- 17- Hyperammonemia
 - Written by Dr Fatma AlAbdulRazzaq
 - Reviewed by Dr Amirah AlKandari and Dr Nawal Makhseed
- 18- VLCAD
 - Written by Dr Hind AlFaraj
 - Reviewed by Dr Amirah AlKandari and Dr Nawal Makhseed
- 19- Hypocalcemia
 - Written by Dr Maryam Burezzq
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 20- Hyperkalemia
 - Written by Dr AbdulAziz AlEnezi
 - Reviewed by Dr Hussein Sadeq
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 21- Hypokalemia
 - Written by Dr Khalaf AlShemmeri
 - Reviewed by Dr Nasser AlKhulaifi
- 22- Sodium (Hyponatremia, Hypernatremia, Hypernatremic seizure)
 - Written by Dr Hussein Sadeq

- Contributions and edits from Dr Fajer AlTammar and Dr Abdullah AlFraij
- 23- Hypoglycemia
 - Written by Dr Salman AlAsfour
 - Reviewed by Dr Hussein Sadeq
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 24- DKA
 - Written by Dr Fajer AlDarweesh
 - Reviewed by Dr Hussein Sadeq
 - Contributions from Dr Fahad AlJasser and material obtained from Dr Maria AlMahdi
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 25- Anaphylaxis
 - Reviewed by Dr Sarah AlJamaan
 - Contributions and edits by Dr Fajer AlTammar and Dr Abdullah AlFraij
- 26- Neonatal fever (0-21 days)
 - Written by Dr Noor AlMoosawi
 - Reviewed by Dr Danah alsharrah and Dr Mohammad Alghunaim
- 27- Neonatal fever (22-28 days)
 - Written by Dr Noor AlMoosawi
 - Reviewed by Dr Danah alsharrah and Dr Mohammad Alghunaim
- 28- Well febrile infant (29-90 days)
 - Written by Dr Noor AlMoosawi
 - Reviewed by Dr Danah alsharrah and Dr Mohammad Alghunaim
- 29- Ill febrile infant (29-90 days)
 - Written by Dr Noor AlMoosawi
 - Reviewed by Dr Danah alsharrah and Dr Mohammad Alghunaim
- 30- Fever without a focus (3-36 months)
 - Written by Dr Noor AlMoosawi
 - Reviewed by Dr Danah alsharrah and Dr Mohammad Alghunaim
- 31- Non-chemotherapy induced febrile neutropenia
 - Written by Dr Rayan AlHendyani
 - Reviewed by Dr Danah AlSharrah and Dr Mohammad AlGhunaim
- 32- Pediatric antibiotic guidelines
 - Written by Dr Hind AlFaraj
 - Reviewed by Dr Fatma AlMousawy
- 33- Fever in sickle cell disease
 - Written by Dr Saja AlShemmeri
 - Reviewed by Dr Abdullah Taqi
- 34- Vaso-occlusive crisis in sickle cell disease
 - Written by Dr Khaled AlAfassy
 - Reviewed by Dr Maha Buresli
- 35- Acute chest syndrome
 - Written by Dr Saja AlShemmeri
 - Reviewed by Dr Abdullah Taqi
- 36- Bleeding tendency
 - Written by Dr Khaled AlAffasy
 - Reviewed by Dr Abdullah Taqi
- 37- Complete Kawasaki
 - Written by Dr Alaa Shehab
- 38- Incomplete Kawasaki
 - Written by Dr Alaa Shehab
- 39- Important toxicology mnemonics
 - Written by Dr Zaina Jamal
 - Reviewed by Dr Mohammad AlHumaidan and Dr Hanan Mandani
- 40- Acute paracetamol ingestion
 - Written by Dr AbdulHadi Safar
 - Reviewed by Dr Mohammad AlHumaidan and Dr Hanan Mandani
- 41- Organophosphate and carbamate poisoning
 - Written by Dr Sharifa Redha
 - Reviewed by Dr Mohammad AlHumaidan and Dr Hanan Mandani
- 42- Hydrocarbon ingestion
 - Written by Dr Sharifa Redha
 - Reviewed by Dr Mohammad AlHumaidan and Dr Hanan Mandani
- 43- Minor head injury <2 years
 - Written by Dr Saja AlShemmeri
 - Reviewed by Dr Hanan Mandani
- 44- Minor head injury >2 years
 - Written by Dr Saja AlShemmeri
 - Reviewed by Dr Hanan Mandani
- 45- Drowning (submersion)
 - Written by Dr Duaa AlEssa
 - Reviewed by Dr Hussein sadeq
- 46- Burns
 - Written by Dr Khaled AlAfassy
 - Reviewed by Dr Hanan Mandani
- 47- Emergency Medications
 - Written by Dr Saja AlShemmari
 - Adapted from *PALS 2020*

48- Infusions

- Written by clinical pharmacist Olivia Hanna

49- Vaccination schedule (Kuwait, 2019)

- Written by Dr Noura AlSaeed
- Adapted from Kuwait ministry of health childhood immunization schedule 2019

50- Reading a chest x-ray

- Written by Dr. Raghad Aleinati
- Reviewed by Dr Nawal Akbar

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Dr. Zainah Jamal

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